A Scranton Gillette Publication

JANUARY 1958

WATER & SEWAGE WORKS

UNIVERSITY MICROFILMS
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COMP.

▲ WHAT IS IT?—Calcite Crystals! . . p 21

1957 Water Supply Progress in Review . . p 1

Redox Potential For Sludge Digestion Control . . p 37

News Summary . . p 3A Equipment News . . p 9A Bulletins . . p 25A

LOCK JOINT ECONOMIES: *One of a Series*

It's a bargain!

If Peter Minuit were alive today probably nobody would be more surprised than he at the extent of the bargain he made with the Indians for Manhattan. His $24 investment now has an assessed valuation of more than $7,000,000,000.

But no one should be surprised at the value offered by LOCK JOINT CONCRETE PRESSURE PIPE. For a great many years the low first cost of this pipe has been assured by keen competitive bidding, its simplicity and speed of installation have helped to reduce construction costs, its record for dependable, trouble-free service has been unexcelled and its operational and maintenance costs have been minimal.

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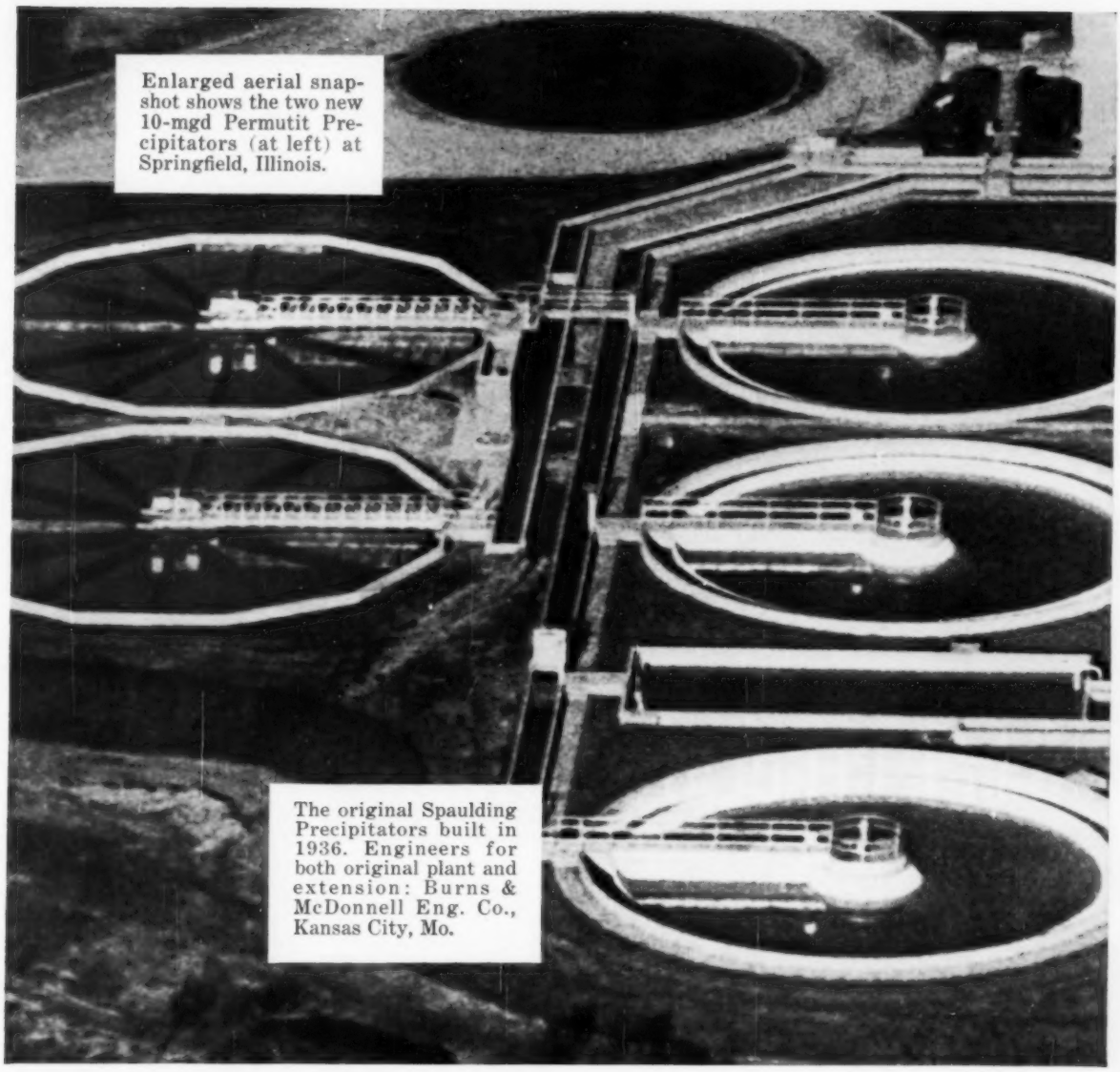

Enlarged aerial snapshot shows the two new 10-mgd Permutit Precipitators (at left) at Springfield, Illinois.

The original Spaulding Precipitators built in 1936. Engineers for both original plant and extension: Burns & McDonnell Eng. Co., Kansas City, Mo.

20-year record proves efficiency of upflow "Precipitators"

In 1936, Springfield built three short-detention, upflow softening-coagulation units newly developed by Charles H. Spaulding. From the start, the Spaulding-designed units showed high flow rates – many times faster than the old basin system, a uniform quality effluent that doubled filter capacity, a low chemical cost and a low maintenance cost.

When Springfield's recent expansion program called for doubling its water-treating capacity, city engineers had almost 20 years of proven performance to guide them, a longer performance record than is available with any other type of upflow, sludge-blanket unit. That's why Permutit Precipitators based on Spaulding designs were chosen for the new units.

For complete details on any type of water conditioning equipment, write: The Permutit Company, Dept. W-1, 50 W. 44th St., New York 36, or Permutit Company of Canada, Ltd., Toronto 1, Ont.

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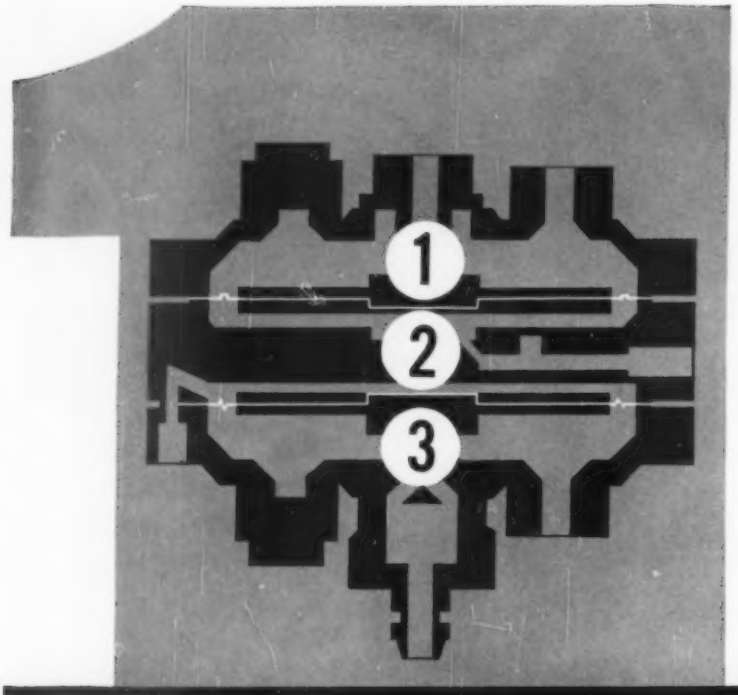

3-in-1 REGULATOR STACK*

simplifies construction, minimizes maintenance of F & P chlorinator

The simplicity of F & P Model 1050A Chlorinator is truly an outstanding example of modern instrument engineering. Originally designed with individual regulators, the first F & P Chlorinators were vastly superior to any other chlorinators then on the market. Taking advantage of their product lead, F & P engineers continued researching optimum chlorinator design and performance, and came up with a new idea—*stacked regulators!*

The 3-in-1 regulator stack shown above combines (1) differential pressure regulator, (2) vacuum breaker and pressure relief, and (3) vacuum regulator and safety shutoff into one convenient unit. This design simplifies the flow system by reducing the amount of piping required and arranging the regulator components in line . . . in one, easy-to-service package. Components are made and tested separately . . . assembled . . . and then retested as an integrated unit. *F & P is the only company able to offer this 3-in-1 regulator feature.*

*Patent applied for.

Other features that make this F & P chlorinator an outstanding buy in trouble-free performance and economy include: dependable, positive-acting safety system . . . direct reading flowmeter—you see the rate of flow! . . . built-in capacity flexibility, ranging from 0.1 ppd to 2000 ppd . . . construction materials completely inert to chlorine corrosion . . . accuracy well within ±4% . . . no special skills required to install or operate.

The fiber glass plastic cabinet, available in a variety of colors, is completely resistant to corrosion . . . never requires painting or coating.

Get all the facts on the performance-tested Model 1050A Chlorinator by writing for Catalog 70C140. If you're from Missouri, we'll be happy to send you a list of see-it-for-yourself installations. Write Fischer & Porter Company, 218 Fischer Road, Hatboro, Pa. In Canada, write Fischer & Porter (Canada) Ltd., 2700 Jane Street, Toronto, Ontario.

FP

FISCHER & PORTER CO.

Complete Process Instrumentation

Vol. 105 No. 1

January · 1958

WATER & SEWAGE WORKS

A Scranton Gillette Publication

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GEORGE E. SYMONS, *Ph.D.*
Editor

Editorial Associates
A. M. RAWN J. R. BAYLIS
C. E. KEEFER L. L. HEDGEPETH
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CHICAGO OFFICE: 185 North Wabash Avenue
E. S. Gillette, Publisher
H. J. Conway, Adv. Ed.
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E. C. Heath, Sales Repr.
R. J. Rooney, Make-Up Editor
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NEW YORK OFFICE: 155 East 44th St.
Editorial
George E. Symons, Editor
F. C. Maurer, Associate Editor

Business
T. M. Todres, Administrative Assistant
Evans J. Kall, Eastern Sales Mgr.
Wm. R. Joyce, Midwestern Sales Mgr.
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85 Post Ave., San Francisco 4, Calif.
Duncan A. Scott & Co.

2978 Wilshire Blvd., Los Angeles 5, California
Duncan A. Scott & Co.

1201 Forest View Lane, Birmingham 9, Ala.
Fred W. Smith, Sales Rep.

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Technical Developments in WATER SUPPLY PROGRESS *in 1957 were outweighed by public awareness of adequate water needs according to . . . L. S. Finch* 1

A new idea which employs CALCITE IN WATER TREATMENT *is described by T. M. Riddick, N. Lindsay and A. Tomasi* 15

Near Boston is a brand new METER FACTORY *of the Hersey Mfg. Co.* 25

A symposium on TRICKLING FILTER PERFORMANCE *is covered in a report on the PaSIWA meeting* 28

A Technical Discourse on SEWAGE FILTERS *is another article in the series by Theodore Jaffe* 31

The investigation of REDOX POTENTIALS *as a new tool in sludge digestion control is reported by W. N. Grune and T. H. Lotze* 37

An Evaluation of PUBLIC LAW *660 is included in Part 2 of the Report on the FSIWA Boston Meeting* 42

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Installing 48" Pratt High Pressure Rubber Seat Butterfly Valve in a Toledo, Ohio water main. Engineers: City of Toledo Water Department; George Van Dorp, Chief Engineer.

TOLEDO . . . Chooses Pratt Butterfly Valves for Water Mains

Long after this valve is buried, in six months or sixty years, it will still be **easily opened or closed by one man using a standard tee-wrench.** The design features of Pratt Valves are aimed at the kind of honest dependability you need for water main use . . . the disc edge is corrosion-resistant and seats accurately in a rubber liner made extra-heavy to prevent permanent set. The one-piece stainless steel valve shaft rotates in lifetime lubricated bronze bearings, and the operator is permanently lubricated and sealed to withstand seepage.

In 1956, the City of Toledo purchased 13 Pratt Rubber Seat Butterfly Valves for its water mains, in 24", 30", and 48" diameters. All of them were designed for buried service without the need for protective vaults around valve or operator, **adding substantial savings in installation costs** to their proven freedom from maintenance problems.

Pratt engineers stand ready to help you select valves for distribution service or any water works application. Call on them with your next valving problem.

Have you sent for your copy? . . . of Pratt's 40 page Manual of Rubber Seat Butterfly Valves. Useful—contains latest pressure drop and flow data, conversion tables, butterfly valve theory and application. Catalog B-2B

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NEWS SUMMARY

The 1957 Annual Index of *Water & Sewage Works* is now available and may be obtained by writing our editorial office in New York.

Water Supply Progress in 1957 was marked by a growing awareness on the part of the public of the importance of adequate water supply. New equipment, process developments, and construction as well as AWWA activities are presented by AWWA Vice President, Lewis S. Finch—page 1.

Calcite in water treatment is something new in coagulation when mixed with alum and added to water. This new treatment process is only one of several new features of the Oneonta, N. Y., water works. The fundamentals and application of the calcite-alum treatment is described by T. M. Riddick and his associates—page 15.

Redox Potential Measurements offer a new tool in the control of anaerobic sludge digestion. A new ORP cell is described; it will not plug and offers possibilities not previously available. Experiments using this new cell are described by Messrs. Grune & Lotze—page 37.

Dr. George E. Symons is now Editor of *Water & Sewage Works* as well as Executive Vice President and Editorial Director of Scranton Publishing Co., Inc.—page 44.

Water & Sewage Works introduces a number of changes in format and typography to improve readabiiity and usefulness—See entire issue—and announces new office, Room 204 at 155 E. 44th Street and a new Telephone No. Murray Hill 2-8326—See editorial page.

Fred Maurer has been promoted to position of Associate Editor of *Water & Sewage Works* as of Jan. 1—page 36.

H. E. (Ted) Moses, long-time Chief Engineer of the Penna. State Dept. of Health, died on Nov. 13, 1957, in his 83rd year—page 27.

John E. Wakefield is the new head of the Department of Water Resources of the Florida State Board of Health—page 36.

Booster Pump mounted inside a water main is a completely new idea being tried out by the St. Louis County Water Co. This new underground water pump is manufactured by Jacuzzi Bros. in St. Louis—page 9A.

Flomatcher system of pumping rate control (developed by T. B. Hayes of Cornell, Howland, Hayes & Merryfield) is a new device for simple, automatic, stepless flow rate control. Manufactured by General Services Co.—page 9A.

The Manufacturing Chemists Assn. has published complete proceedings of its 1957 Air and Water Pollution Abatement Conference held in April, 1957. Available at $2.00 a copy—1625 Eye St., N.W., Washington 6, D. C.

Robert A. Taft Sanitary Engineering Center in Cincinnati is completing pilot plants for water and sewage treatment. Both will be ready for operation soon; they are housed in an 84 x 48 ft. wing of the Center. The water plant has a capacity of 40 gpm; the sewage plant a capacity of 50 gpm. Complete flexibility is a feature of both plants.

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FLUORIDATION

You get three-way economy, safety and assurance of ample supplies with

INTERNATIONAL
HYDROFLUOSILICIC ACID

Municipalities save three ways with *International Hydrofluosilicic Acid:* in cost of equipment installation, in operating cost and in cost of materials. Handling and control of liquid feed is simple and easy with a minimum of space needed for storage.

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Shipments are currently being made from plants at Mason City, Iowa; Chicago Heights, Illinois; Lockland (Cincinnati), Ohio; Buffalo, New York; East Point, Georgia; Hartsville and Spartanburg, South Carolina and Tupelo, Mississippi. Other shipping locations will soon be available.

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If you are fluoridating now or planning to do so soon, it will pay you to talk with *International's* representative about the use, handling and costs of *Hydrofluosilicic Acid*. Please write or phone the office near you.

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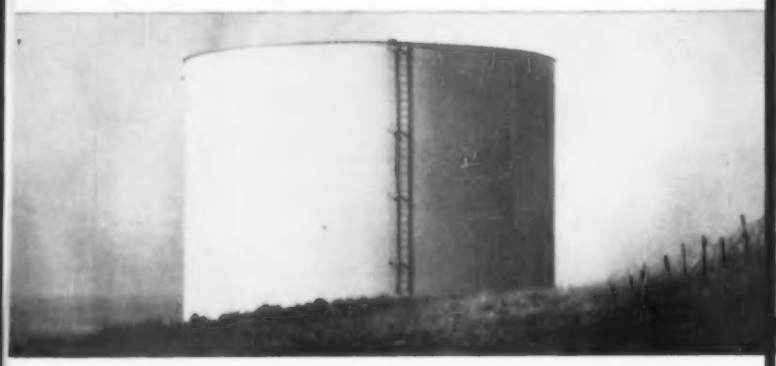

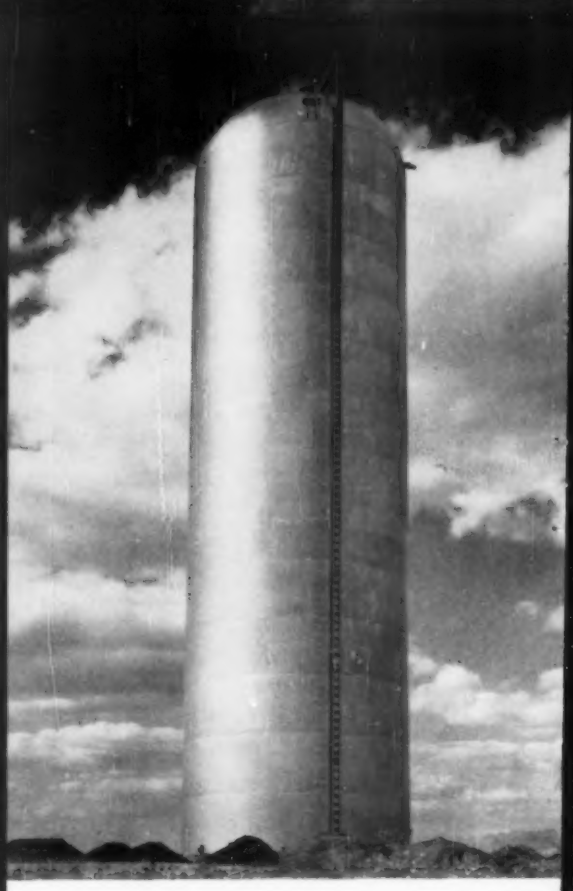

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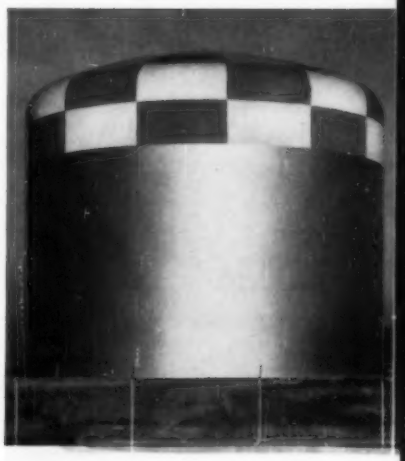
you need the advantages of site
plus

reservoirs and standpipes

by

Pittsburgh-Des Moines

The combination of adequate site elevation and Steel Reservoirs or Standpipes can assure rockbottom water storage costs for many communities. PDM steel water storage units are strong, permanently watertight, low in maintenance, and are guaranteed in design, workmanship and materials. Let us quote on your water storage requirements from 50,000 to 5,000,000 gallons and up. Write for descriptive bulletin.



Pittsburgh-Des Moines Steel Company

Plants at: PITTSBURGH, DES MOINES, SANTA CLARA, FRESNO, and CADIZ, SPAIN

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DES MOINES (8)	919 Tuttle Street
DALLAS (1)	1223 Praetorian Building
SEATTLE (1)	Suite 526, 500 Wall Street
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DENVER (2)	323 Railway Exchange Bldg.

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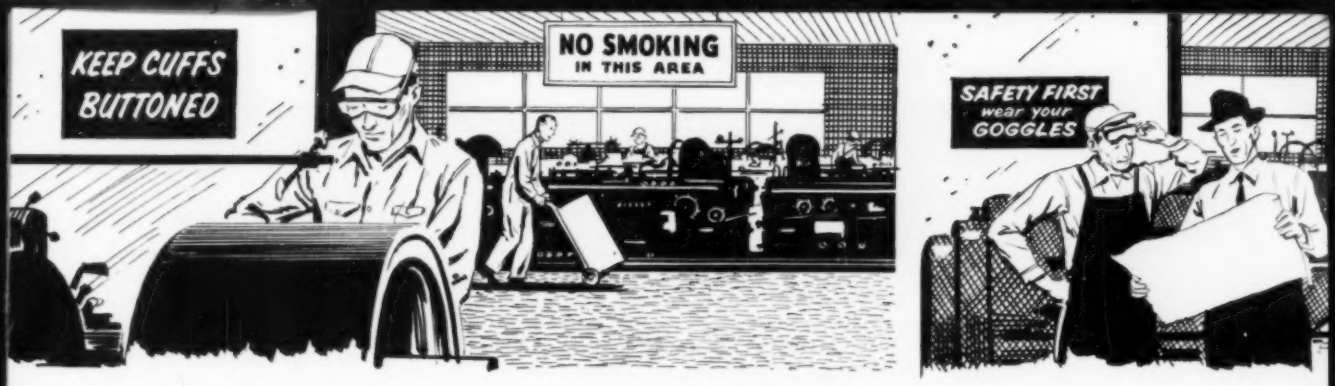
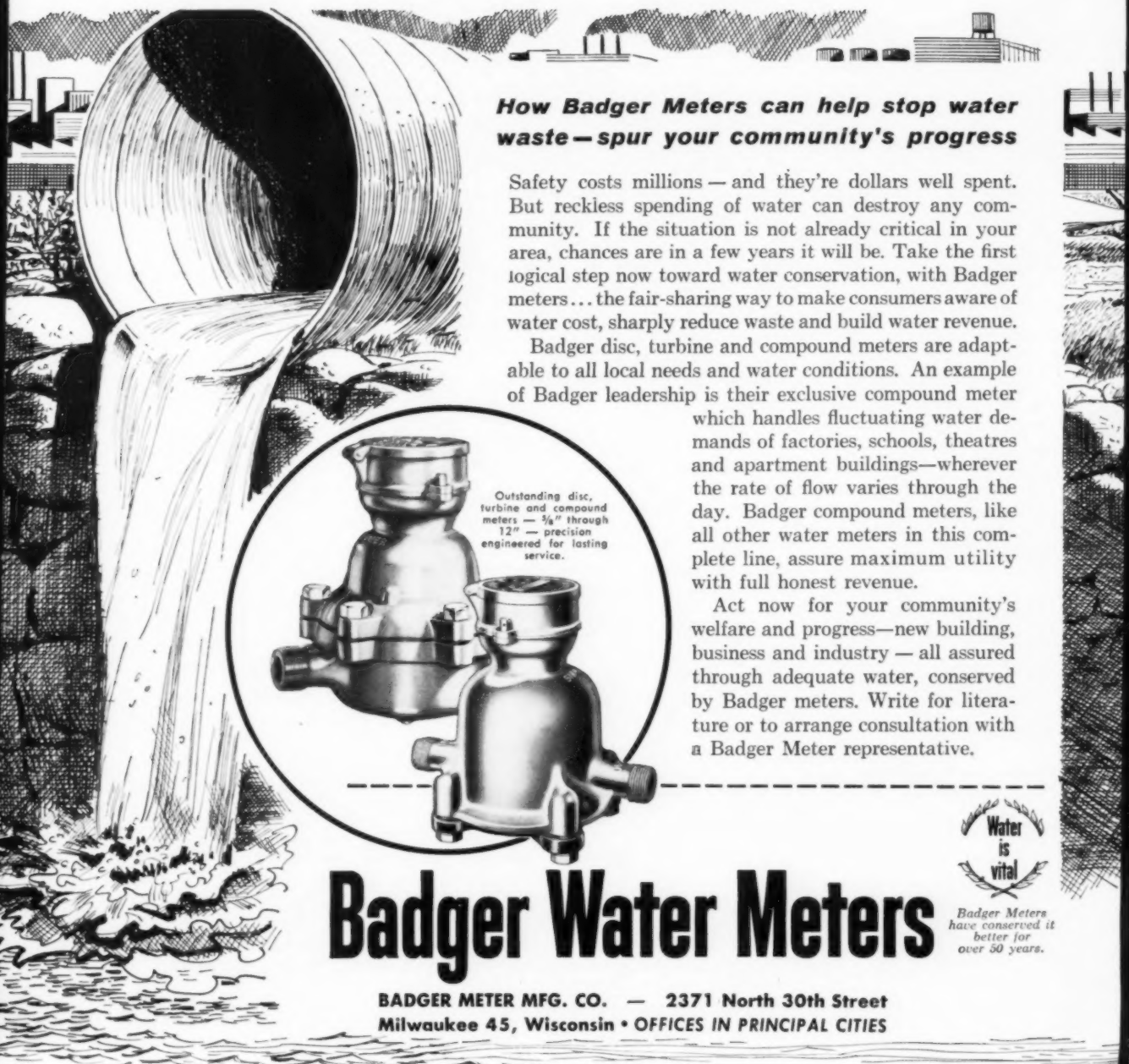


Men and property guarded

but how about our most precious possession . . . water?



How Badger Meters can help stop water waste—spur your community's progress

Safety costs millions — and they're dollars well spent. But reckless spending of water can destroy any community. If the situation is not already critical in your area, chances are in a few years it will be. Take the first logical step now toward water conservation, with Badger meters . . . the fair-sharing way to make consumers aware of water cost, sharply reduce waste and build water revenue.

Badger disc, turbine and compound meters are adaptable to all local needs and water conditions. An example of Badger leadership is their exclusive compound meter which handles fluctuating water demands of factories, schools, theatres and apartment buildings—wherever the rate of flow varies through the day. Badger compound meters, like all other water meters in this complete line, assure maximum utility with full honest revenue.

Act now for your community's welfare and progress—new building, business and industry — all assured through adequate water, conserved by Badger meters. Write for literature or to arrange consultation with a Badger Meter representative.

Outstanding disc, turbine and compound meters — ⅝" through 12" — precision engineered for lasting service.

Badger Water Meters

Water is vital

Badger Meters have conserved it better for over 50 years.

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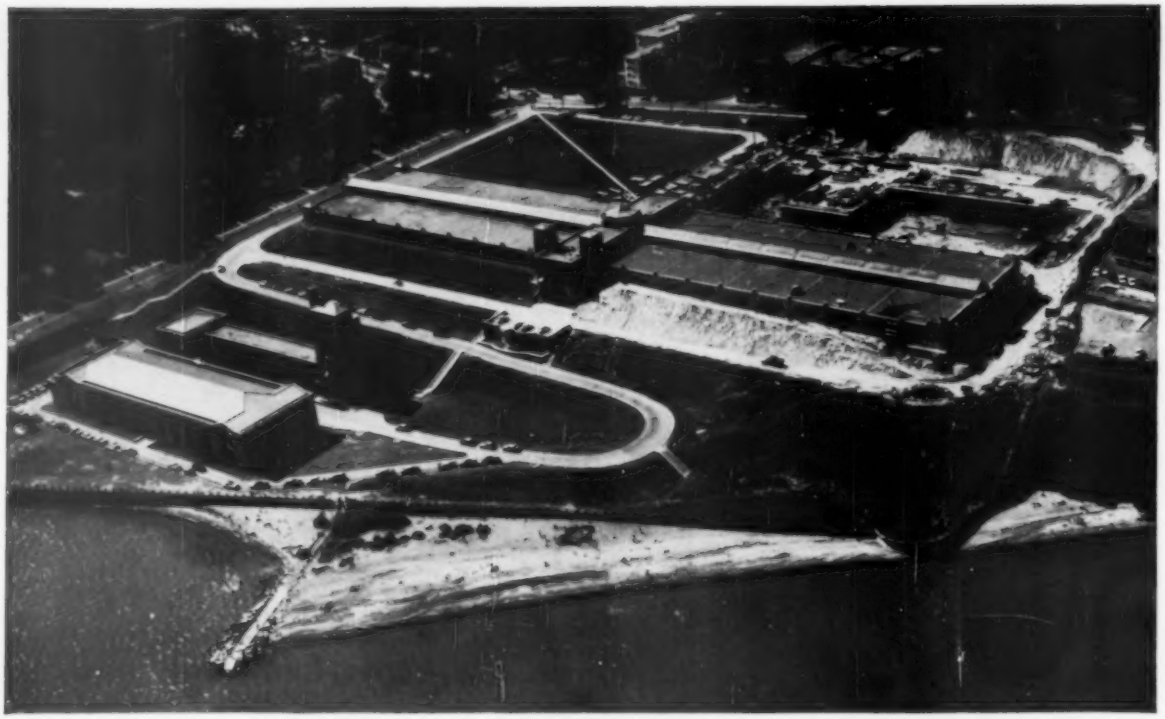


Aerial view of the R. C. Harris Plant of The Municipality of Metropolitan Toronto; R. L. Clark—Commissioner of Works. Photograph was taken during construction of plant's additional facilities.

New plant extension for Toronto, Canada used Leopold Butterfly Valves

When the R. C. Harris Plant of The Municipality of Metropolitan Toronto, Canada, was constructed in 1939 with an initial capacity of 100 million Imperial gallons per day, provision was made for future extension to twice that capacity.

With the recent completion of this extension, which has been under construction since 1955, 200 million gallons per day are now available to meet the expanding needs of the fast-growing Metropolitan Toronto area. For this modern plant addition, Leopold class 50-16 rubber seat, tight shut-off 30" hydraulically operated butterfly valves were selected for use on the twenty filter wash water lines.

More and more water treatment plants are specifying Leopold equipment for dependable performance, long life, and economy. If you're planning on new plant construction or modernization of your present facilities, it will pay you to consider the advantages of Leopold products. Write for complete information, without obligation.

Workmen shown installing one of the Leopold 30" Butterfly Valves at the R. C. Harris Plant.

Leopold

F. B. LEOPOLD CO., INC.
ZELIENOPLE, PA.

COMPLETE WATER PURIFICATION AND FILTER PLANT EQUIPMENT • BUTTERFLY VALVES
FILTER OPERATING TABLES • MIXING EQUIPMENT • DRY CHEMICAL FEEDERS
GLAZED TILE FILTER BOTTOMS • FIBERGLAS-REINFORCED PLASTIC WASH TROUGHS

Equipment News

Pumping Rate Control

101

General Services Company, Corvallis, Ore., has announced plans for early introduction to the sewage treatment field of their Flomatcher system of pumping rate control.

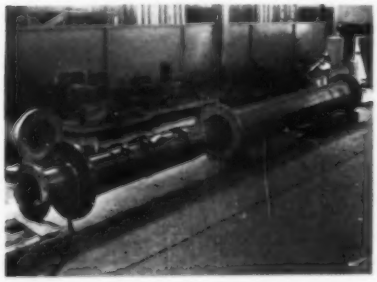
The Flomatcher system was developed and patented by Thomas B. Hayes of Cornell, Howland, Hayes & Merryfield of Corvallis to meet a growing need in the liquid pumping field for a simple, automatic, stepless flow rate control. Flomatchers, controlling sewage pumps, are operating in Eugene, Corvallis, Albany, Pendleton, Forest Grove, Lebanon, Cottage Grove and Coquille, Oregon; in Caldwell, Idaho; and in Anderson and Fairfield, California. The first unit was installed in Eugene, Oregon, in October, 1950.

New Water Pump Mounts Inside Main

102

Jacuzzi Bros., Inc., St. Louis, Mo., has announced that operational tests are underway by the St. Louis County Water Company of a completely new type underground water pump which can be installed in a water main almost as easily as a regular section of pipe and which may reduce both the cost and time of installing booster pumps in the County.

Presently the largest of its kind in the nation, the pump and motor unit is of the submersible type and is mounted in a section of pipe installed horizontally in the water main. The



unit is capable of pumping 4,000,000 gallons per day and is driven by a 75-horsepower electric motor. The motor runs in a pressure oil bath and is completely submersed in water.

Conventional booster pumps generally are installed in concrete vaults near the water main and require extensive excavation and construction time.

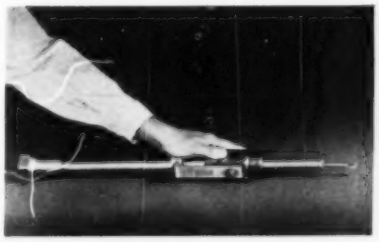
The new booster pump being tested by the County Water Company is in a section of main on Lucas and Hunt Road in the northern part of the County and serves to increase water pressures in that area of the Company's distribution system.

The new pump is the second in the nation, a smaller unit being used in California on a test basis. The motor is designed to operate several years without attention.

Compact Pitot Tube

103

C-Mar Corp., Manasquan, N. J., has available a new compact pitot tube. Made of stainless steel, bronze, brass or monel, the C-Mar pitot tube can be used to measure flow rates of gases, fresh water, salt water, oil and other liquids.



Requiring only a small opening for insertion into the pipe or duct, the pitot tube is particularly useful in experimental engineering—for cut-and-try design work where a number of measurements must be made before system design is final. The small conduit openings required are easy to close later.

Principal applications of the C-Mar pitot tube are: (1) where a temporary flow measuring installation is required, (2) for measuring flow on a permanent basis where the size of the pipe or duct is too great to make an orifice plate installation practical, (3) in test work, for measuring a number of different points in a line and for exploring flowrates or velocity distribution in apparatus already built, and (4) for traversing a pipe or duct

CONTINUED ON PAGE 11A

superior coagulation in cold water months with N-SOL (ACTIVATED SILICA)

● Brilliantly clear water, and longer filter runs are results you can count on when you use activated silica made by an N-Sol Process.* As a coagulant aid N-Sol produces tough, compact floc and a much faster settling floc.

Write for instructions and samples for jar tests.

**N-Sol is prepared in your plant with N sodium silicate and a reacting chemical. No charge for license under our N-Sol Process Patents.*

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Equipment News

CONTINUED FROM PAGE 9A

to determine the velocity distribution in the line.

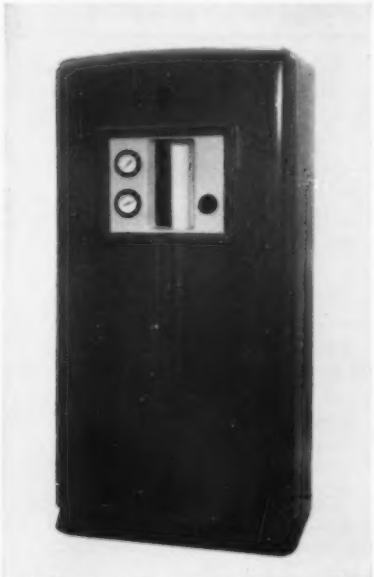
A safety lock permits the C-Mar pitot tube to be secured in any position, providing safety at all times—even when running a traverse. This lock assembly also automatically positions the tube so that the impact opening always faces exactly upstream for maximum accuracy.

New Chlorinator Feeds Up to 8000 Lbs. per Day

104

Wallace & Tiernan, Inc., Belleville, N. J., has announced the addition of a new chlorinator to their line of V-notch equipment. The new chlorinator can meter and feed up to 8000 lbs of chlorine per 24 hrs.

The new Series A-721 chlorinator is adaptable to any type of chlorinator control. The feed rate may be adjusted manually or controlled automatically on a flow proportional or selective rate basis.



The unit is constructed of plastic materials for corrosion resistance. Vacuum operation of the chlorinator assures safety for plant personnel and equipment.

CONTINUED ON PAGE 13A

3 feet of frost...
trench 5 feet deep...
30 inches per minute

CLEVELAND TRENCHERS, like Sunberg Well Company's Model 110 working here on the installation of 38,000 feet of 4-inch main in tough frost digging in DeSoto, Iowa, have *for over 25 years* delivered ***more trench . . . in more places . . . at less cost.***

Clevelands are built by The Pioneers of the Modern Trencher, originators of *every* important trencher design feature. There's a Cleveland for every trenching job and you'll find them working everywhere, giving good *reliable* production on tough jobs as well as easy ones—and doing it for year after year.

THE CLEVELAND TRENCHER CO.
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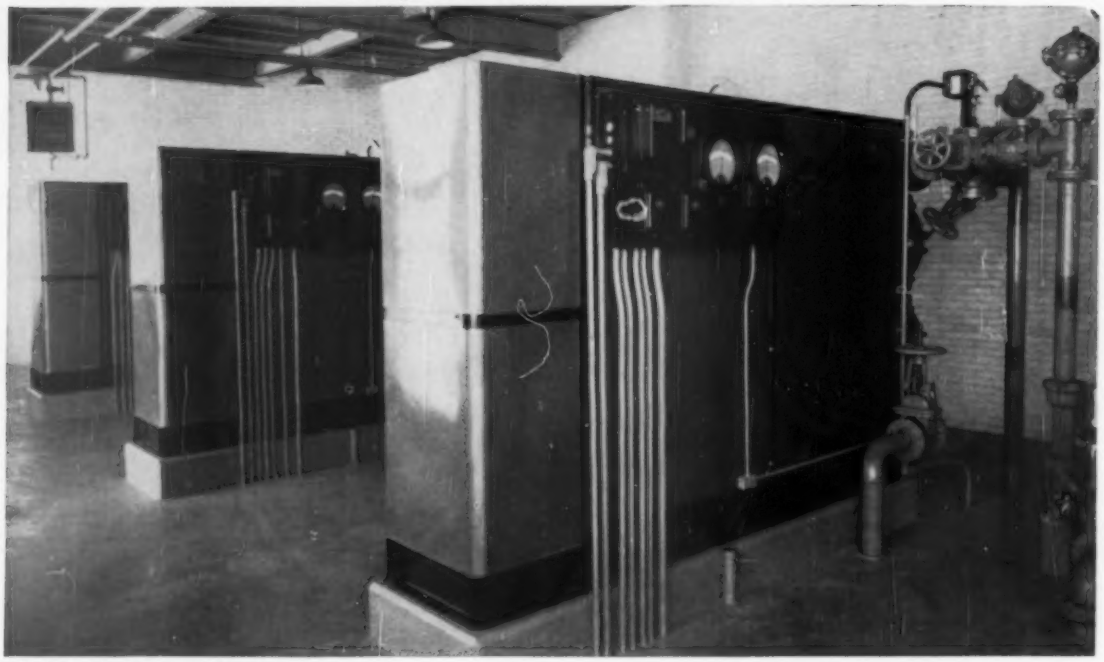
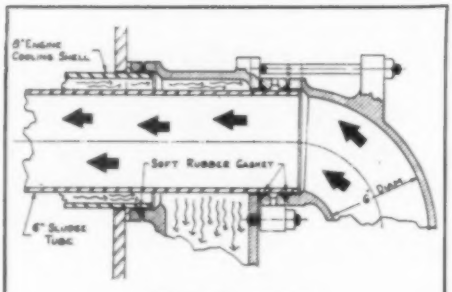
Good Everywhere

Three P.F.T. Heater and Heat Exchanger units serve modern plant at York, Pa.



At York, Pennsylvania . . .

3 P.F.T. Digester Heat Exchangers installed for most efficient operation



POSITIVE SAFETY FROM CONTAMINATION

In these P.F.T. Exchangers, 6" interior tubes carry sludge, while 8" outer tubes carry heating water in the opposite direction (counterflow). Exclusive P.F.T. multiple-gasket joint design makes any leakage of sludge quickly detectable on the *outside* of the unit. This positively prevents contamination of water circulating in the 8" tubes, and safeguards the cooling system against costly clogging.

P.F.T. is the only manufacturer of both *shell and tube* type and *concentric tube* heat exchangers for sewage treatment. York thus could be sure of getting the best suited equipment for their sludge heating operation.

After careful analysis, three *P.F.T. #605 Heat Exchangers* of the concentric tube type were specified. Rated output is 1,000,000 B.t.u. per hour each. All parts are readily accessible. Return bends are easily removed for inspection and cleaning of both sludge and water tubes.

Digesters are economically heated by transferring waste heat from two 150 hp. gas engines to sludge recirculating through the #605 exchangers. *P.F.T. Gas Safety Equipment* protects the digesters and sludge gas system from flash-backs at the engines and boilers.

Design of plant by / *Albright and Friel, Incorporated Consulting Engineers Philadelphia, Pa.*

P.F.T.

waste treatment equipment exclusively since 1893

PACIFIC FLUSH TANK CO.

4241 Ravenswood Avenue
Chicago 13, Illinois

News Equipment

CONTINUED FROM PAGE 11A

Reservoir Fish Control

105

Chemical Insecticide Corporation, Metuchen, N. J., has developed a new product known as Chem Fish Special "HFN".

Chem Fish Special is designed for the control of rough fish, such as: carp, perch, etc., in reservoirs used for drinking water. Extensive tests by the United States Public Health Service have cleared only this product to date for rough fish control, so that there is no adverse affect upon the potability of the water or other undesirable after effects. Tests show that within seven days after treatment the threshold of odor and taste reaches yellow.

Chem Fish Special "HFN" will enable the cities and towns with resservoirs to now improve local fishing conditions through the use of a nontoxic product without adversely affecting local water supplies.

Water Indicator-Totalizer

106

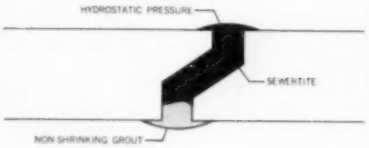
Sparling Meter Company, El Monte, Calif., has just announced the completely new Sparling Indicator-Totalizer Type 245, designed exclusively for water works use. Providing

flow rate and totalization in any standard measurement, it is furnished as an integral part of the Sparling-Masterflo Main-line Meter, and can be directly mounted on all standard Sparling Meters. Housed in compact unit measuring only 4¾" high, the rugged mechanism has the precision of a watch mechanism. Heavy duty, corrosion resistant materials provide for long life on main-lines. Flow rate is indicated similar to that of a "speedometer" on an easily read 3" dial.

Hydrostatic Pressure Used In Sealing Sewer Pipe Joints

107

Philip Carey Mfg. Co., Cincinnati, Ohio, has announced the development of a method of employing natural hydrostatic pressure as an aid in sealing concrete sewer pipe joints.



This new method was developed by Edward Witter of Witter-Gaddis, Inc., Schererville, Ind., and approved by the engineer, Joseph Adams of Hurst-Roche Co., Hilsboro, Ill.

Mr. Witter, in laying large sewer pipes in Gary, Ind., found hydrostatic pressure at the bottom of the trench to run as high as 7 or 8 pounds. The method employs the use of a cold plastic sewer joint compound "Sewertite". This compound is applied with a trowel to the tongue end of the pipe to a thickness of about ¾ in. The pipe is lowered into the trench and shoved home. The joint is then grouted on the inside with mortar of the nonshrinking type. The hydrostatic pressure forces the "Sewertite" against the inner grout, effectively sealing the joints against water infiltration.

As each section is sealed, a shovel and bulldozer backfill over the sewerline and compact the fill to allow rapid resurfacing.

Meter Features Unique Diaphragm Construction

108

The Foxboro Co., Foxboro, Mass., has developed a new type 37 Diaphragm Meter using preformed highly sensitive diaphragms, stacked to nest together for positive overrange protection to full static pressure.

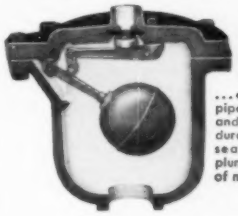
Each pair of diaphragms forming

CONTINUED ON PAGE 17A

Crispin

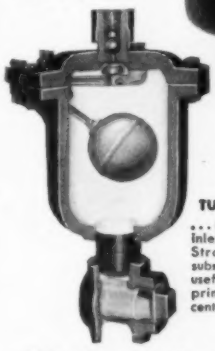
AIR VALVES
are thoroughly
dependable

For positive air control use Crispin Air Valves. Simplified construction, easy accessibility, maximum dependability, minimum maintenance, and efficient operation are advantages built in every Crispin Air Valve.



Crispin
MODEL "P"
AIR VALVES
...eliminate air in pipelines, pumps, tanks and other vessels—durable stainless steel seat and synthetic plunger resist attack of many liquids.

Crispin
DUAL VALVES
...safely release air during line filling and while it is in operation, permit air to enter as line is emptied—low-cost 3-way control.



Crispin
TURBINE VALVES
...control air from inlet through outlet. Strains out foreign substances. Particularly useful with automatic priming systems of centrifugal pumps.

Write, wire or phone for complete information on dependable Crispin Air Valves that keep your pipelines open for safe, economical operation.

AIR CONTROL VALVES FOR OVER 45 YEARS

multiplex
MANUFACTURING COMPANY
BERWICK, PENNSYLVANIA
Dept. B

American Frost Bottom Meter has frost separable gear train and chamber.

THE WATER COMMISSIONER

GUARDIAN OF THE PUBLIC WATER SUPPLY

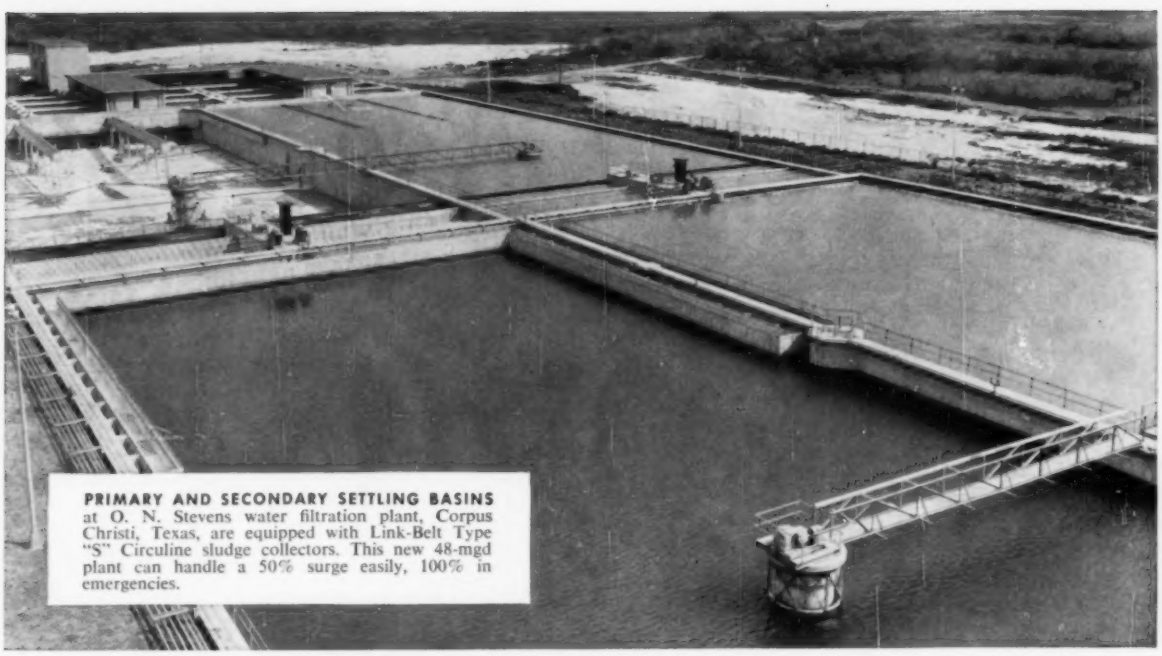
He says: "American Meters help us build for the increased water demands of the future by bringing in full revenue for water used today!"

The major responsibility of the water commissioner is an adequate supply of pure water. He knows that one of the best ways to safeguard an adequate water supply is to eliminate waste and to get a full return for water delivered.

American Meters insure full revenue, because they register accurately — even trickle flows. The secret of this accuracy is the design of the measuring disc to form a more efficient seal . . . another example of American advanced engineering. That's why so many Water Commissioners everywhere buy American!

BUFFALO METER CO.

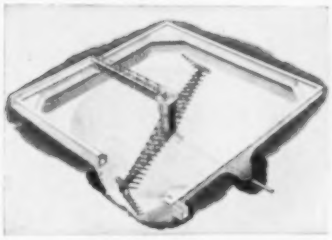
2909 Main Street • Buffalo 14, New York



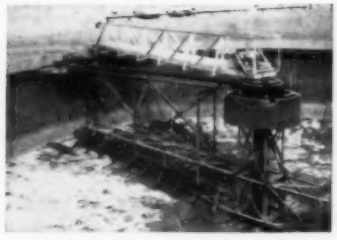
PRIMARY AND SECONDARY SETTLING BASINS at O. N. Stevens water filtration plant, Corpus Christi, Texas, are equipped with Link-Belt Type "S" Circuline sludge collectors. This new 48-mgd plant can handle a 50% surge easily, 100% in emergencies.

Four types of LINK-BELT Circuline collectors

offer positive sludge removal

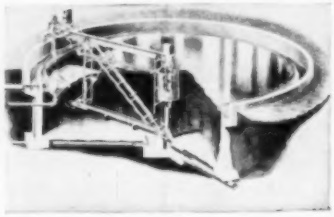


TYPE "S" — specially designed for square and rectangular tanks. As collector revolves, pivoted arms on ends of rakes adjust to thoroughly remove sludge from basin corners.



TYPE "R" — available in models for bottom feed, side feed or cross flow applications . . . in a wide range of sizes. Pitched blades gently convey sludge to center of tank.

TYPE "T" THICKENER — for rugged duty. Similar to "R" collectors except for heavier design. Furnished with fixed rake and automatic or manual lift types.



TYPE "C" — uses simple, positive traction drive to rotate bridge. Slow-speed straightline collector, with long-wearing, corrosion-resistant chains, removes sludge.

There's a design to fit any requirement of tank capacity or construction

THERE's no problem of septicity in settling tanks where Link-Belt Circuline collectors are used. Traveling smoothly and gently, they assure minimum disturbance of flow and the greatest possible concentration and removal of solids in least time.

This efficiency is typical of all the equipment in the complete Link-Belt line for water, sewage and industrial liquids treatment. And it testifies to the value of Link-Belt's more than 35 years' experience in sanitary engineering.

Link-Belt will gladly work with your consultants and chemists on *any* treatment problem. Call your nearby Link-Belt office.

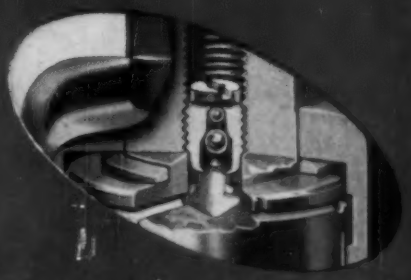
LINK-BELT

SANITARY ENGINEERING EQUIPMENT

LINK-BELT COMPANY: Executive Offices, Prudential Plaza, Chicago 1. To Serve Industry There Are Link-Belt Plants and Sales Offices in All Principal Cities. Export Office, New York 7; Canada, Scarboro (Toronto 13); Australia, Marrickville (Sydney), N.S.W.; South Africa, Springs. Representatives Throughout the World. 14,654

In the spots that count... Homestead Valves are

LEAKPROOF



Reinforced Teflon and lubricant seal

Controlled pressurized lubricant seal

Lower cost per year valve service is guaranteed by Homestead Lubricated Plug Valves. These are the features that make them leakproof and extend their useful life . . . reinforced Teflon* head seal, double ball and lubricant sealed check valve, and their exclusive controlled pressurized lubricant seal.

Homestead's controlled lubricating system forces a chemical film over all sealing surfaces at more than 300 pounds pressure. In addition, it prevents sticking, by its piston-like movement of the plug during each lubrication. See how Homestead fills your valve needs. Write today for Reference Book 39, (Section 5), for complete information on Homestead Lubricated Plug Valves.

*DuPont registered trademark.

h
v

HOMESTEAD VALVE MANUFACTURING COMPANY

P. O. Box 42 • Coraopolis, Pa.

Equipment News

CONTINUED FROM PAGE 13A

the low pressure (range) and high pressure (compensating) diaphragm elements is welded at the outer circumference and to opposing faces of a series of spacing rings at the inner circumference. Overrange pressure on either element forces filling fluid through a connecting passage, around an adjustable damping plug and into the opposite element. The unit under pressure compresses so that the spacing rings form a metal-to-metal column and each pair of diapragms is nested, preventing overrange damage. Measurement is unaffected by temperature variation of the liquid in the elements.

Pressure and Liquid Level Transmitter

109

Conoflow Corporation, Philadelphia, Pa., has available a newly designed pneumatic pressure and liquid level transmitter.

The Model "P" Transmitter is a low cost, rugged instrument capable of measuring pressures as high as 250 psi or ranges from as low as 0 to 100 inches of water. Operating on the simple force-balance principle, the Model "P" transmits a linear 3-15 psi signal to a recorder, indicating gage or manometer. It is suitable for many different services, and especially for those involving viscous fluids or materials which solidify in the static lines of pressure elements of conventional pressure transmitters. It can be mounted either horizontally or verti-

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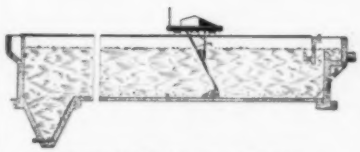
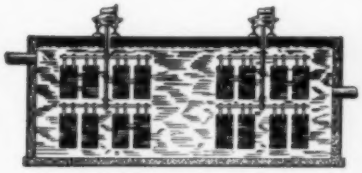
WATER, SEWAGE AND TRADE-WASTE TREATING EQUIPMENT



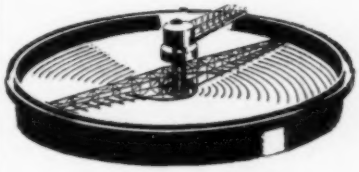
RECTANGULAR CLARIFIERS

Especially suited for limited spaces or where sludge delivery is desired at one end of the tank. A traveling scraper and skimmer carriage removes settled solids from the tank bottom and scum from the top.



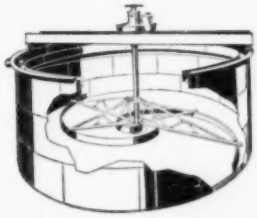
FLOCCULATING UNITS

Slowly rotating paddles on vertical shafts bring the small flocs into contact to form larger masses and hasten precipitation.



CIRCULAR CLARIFIERS

Hardinge Circular Clarifiers are available in sizes up to 200' diameter, either center-column or beam supported for steel, concrete, wood or tile tanks. Sludge scrapers remove settled solids rapidly through central underflow discharge.

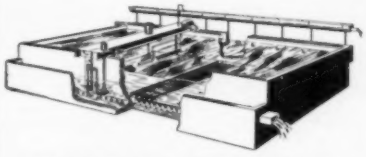


"AUTO-RAISE" THICKENERS

For removal of fine suspended solids from supply water, waste water and sewage. "Auto-Raise" mechanism prevents scraper breakage. Manual or power raise supplements "Auto-Raise." Replaceable ring-type ball bearing support for rotating mechanism. Spiral rakes for maximum underflow density.

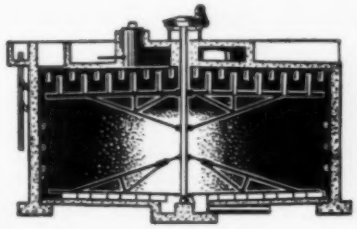
HYDRO-CLASSIFIERS

A large-volume classifier for rapid separation of coarse and fine suspended solids. Frequently used for by-product recovery from waste water.



AUTOMATIC BACKWASH FILTERS

For high removal of non-settling or slow settling suspended matter. Self-cleaning sand bed. No shut-down necessary for backwashing. Traveling backwash mechanism.



DIGESTERS

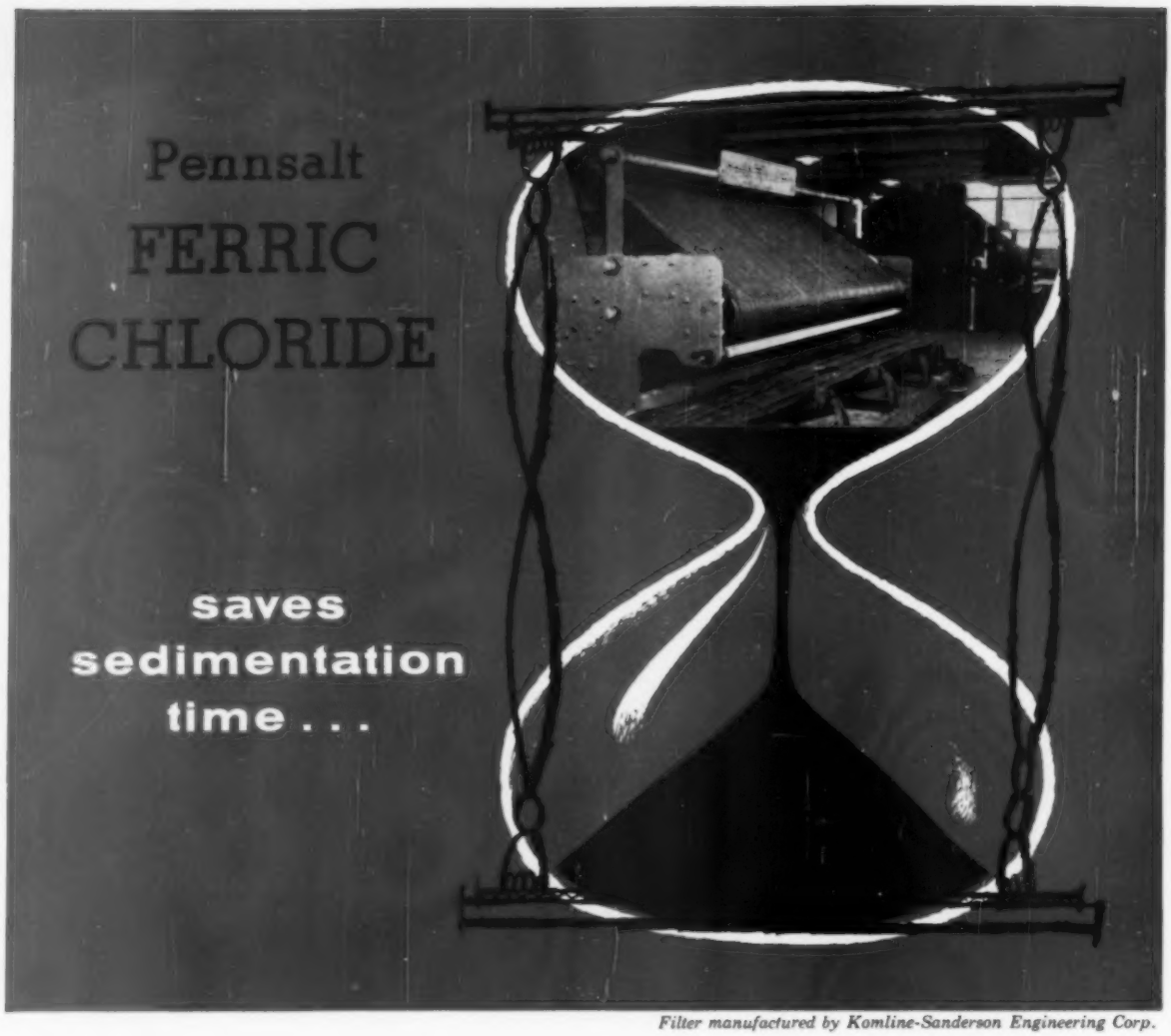
Sludge scrapers and scum breaker arms prevent scum accumulation, insure uniform gas production. Emit a dense digested sludge.

Write for Bulletin 35-D-15

HARDINGE COMPANY, INCORPORATED

YORK, PENNSYLVANIA • 240 Arch St. • Main Office and Works

New York • Toronto • Chicago • Hibbing • Houston • Salt Lake City • San Francisco



Filter manufactured by Komline-Sanderson Engineering Corp.

. . . and gives your filters a new lease on life!

Sewage disposal operations are materially simplified and improved in performance when Pennsalt's Ferric Chloride goes to work. Treating fresh or digested sludge with $FeCl_3$ permits immediate filtration without the usual losses in sedimentation time. It effectively meets any changes in waste composition, does a thorough job of precipitation, and increases filter efficiency.

Pennsalt Ferric Chloride multiplies your vacuum-filter capacities through superior coagulation. This rapid flocculating action produces drier, denser cake, giving you higher output per square foot of filter area.

Anhydrous $FeCl_3$ is available in non-returnable steel drums of 135 and 350 lbs.; liquid $FeCl_3$ is shipped in tank cars. Contact your nearest Pennsalt sales office for full technical information on Ferric Chloride and other chemicals for water purification and sewage: Chlorine, Alum, Perchloron®, and Ammonia.

Pennsalt Chemicals

INDUSTRIAL DIVISION
PENNSALT CHEMICALS CORPORATION
3 Penn Center, Philadelphia 2, Pa.
Regional Offices: Chicago • Detroit • New York • Philadelphia • Pittsburgh • St. Louis
Representatives: Airco Co. International, New York • Pennsalt Chemicals of Canada Ltd., Hamilton, Ontario

Equipment News

CONTINUED FROM PAGE 17A

cally on both open and closed tanks. No dip tubes, floats or other mechanical devices are required inside the vessel. Only the corrosion-resistant Inconel X diaphragm of the diaphragm assembly is wetted by the measured material.

Design of the Model "P" Transmitter eliminates the possibility of measured material backing up into air lines in the event of pressure diaphragm rupture. Ranges can easily be changed in the field. An optional safety shut-off feature is available.

Line-Operated pH Meter

110

Photovolt Corp., New York, N. Y., has just placed on the market a compact and moderately priced line-operated pH meter.

A full-fledged pH Meter, its scale is 3 in. long, covers the complete pH range of 0 to 14, and can easily be read to an accuracy of 0.1 pH unit. This new model is suited for pH tests as well as for titrations. It can be furnished either with individual glass and calomel electrodes, or with "probe" electrode.

Accessories for the new meter are: carrying case, swing-arm adapter; polarizing adapter for Karl Fischer titrations; voltage divider; extension cables for electrodes; etc. The simple instructions are conveniently readable on the engraved top panel.

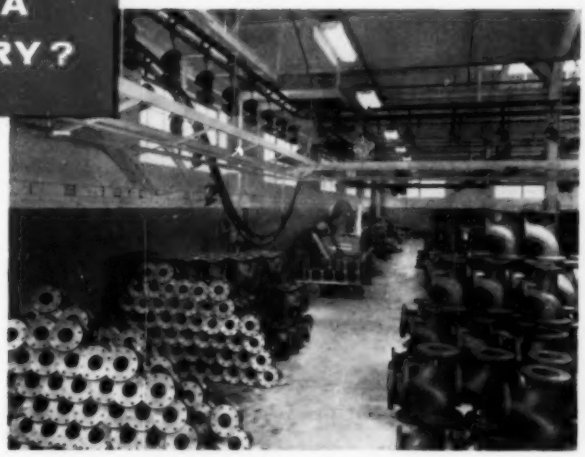
Single-Pen Rate Recorder For Meters

111

F. S. Brainard Company, Hartford, Conn., has just introduced the new Single-Pen Model 571P Meter-Mas-

CONTINUED ON PAGE 21A

NEED FITTINGS IN A HURRY?



You Get Complete Selection and Fast Delivery from Kuhns!

This partial view of our warehouse gives you an idea of the stock we maintain in order to meet your most urgent needs for pipe fittings of any type.

Kuhns cast iron or ductile iron fittings are available coated with a special rust proofing compound, galvanized, or coated to meet your local specifications. Over 3000 sizes and shapes.

Sizes Available

Flanged fittings, all types in sizes from 1½" through 12". Companion flanges; from 1" through 12". Screwed fittings; from ¼" through 12". Every Kuhns fitting is backed with the finest workmanship and strictest quality control that assures you of sharp threads, chamfered edges and perfect sealing. "K" fittings need no "babying"—they'll save time and last longer!

Ductile Iron Fittings

Where corrosion resistance and higher strength are required, Kuhns special ductile iron fittings are available in the same sizes as shown above. These D.I. fittings are all listed and pressure rated by the Underwriters' Laboratories, Inc.

Kuhns fittings are available nationally through better wholesalers.

K

THE KUHNS BROTHERS CO.
1800 McCALL STREET • DAYTON, OHIO
1887 • 70 years of Continuous Progress • 1957

THE OLIVER SUPER 88

"Saves as much as 50% over other equipment"

On this big $15,000,000 shopping center project, Jos. L. Muscarelle, Inc., well-known contractor of Maywood, N. J., has an Oliver 88 on a 5-day-a-week schedule. Working right through the winter—and in frozen ground—the 88 handled all trenching for sanitary sewers, water and electric lines and spot excavations as well as all backfilling. Odd jobs include loading trucks with sand at a nearby pit, as seen above.

The 88 is also used to excavate in cramped areas where steel beams have been erected—and where larger machines can't operate. Here, too, the compact, powerful Super 88 has set up some amazing cost records.

Averages 550′ per day of 5′ trench

So far, the 88 has dug over 25,000′ of trench ranging from 3′ to 11′ deep. Average production for 5′ trenches—at random lengths, in all directions—totals 550′ per day. Cost records show that the Oliver 88 saves as much as 50% in over-all costs over other ½-yd. equipment for this type of work. And the user reports, "No repairs, no breakdowns since the Oliver Super 88 was purchased"—8 months ago!

Ask your Oliver distributor for facts about the Super 88. Or write us for literature.

OLIVER **THE OLIVER CORPORATION**

Industrial Division, 19300 Euclid Ave., Cleveland 17, Ohio

a complete line of industrial wheel and crawler tractors and matched allied equipment.

Equipment News

CONTINUED FROM PAGE 19A

ter, an economical model rate recorder for water meters. The new instrument is designed for applications limited to single register meters.

The simpler, less expensive Single-Pen model was created for use by smaller water departments and industrial users having only single register meters, as well as by companies desiring to use the Meter-Master for "master meter" service.

Like its Dual-Pen counterpart, which can be used on both compound and single register meters, the new Single-Pen Model automatically records the rate and time of flow over a selected period—from 2 hours to 7 days—without interfering with the operation of the meter.

Submersible Well Pumps

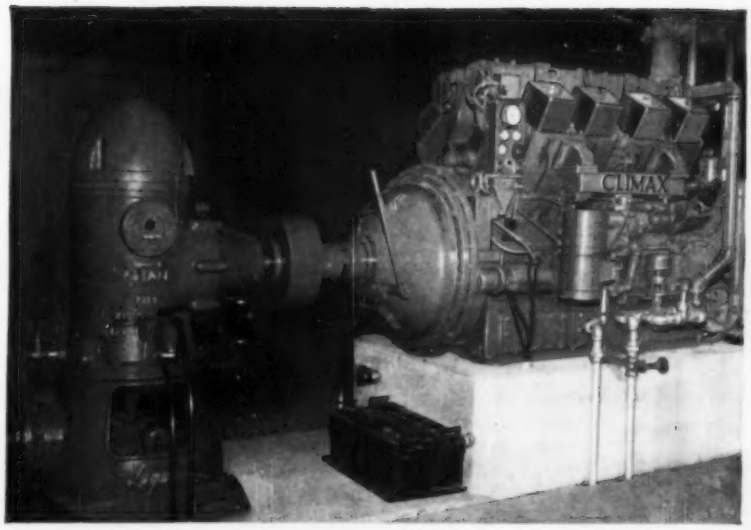
112

Sumo Pumps, Inc., Stamford, Conn., has added new high capacity 50 hp units to its line of submersible pumps for water wells.

New eight in. models are available to deliver capacities to 420 gpm and total heads to as high as 600 ft. A completely new ten-in. line with a pump diameter of 9⅛ in. in 15, 30, and 50 hp sizes delivers up to 640 gpm.

Pump construction utilizes stainless steel and bronze throughout. The units are designed to operate completely in the well, totally submerged in water. The close-coupled pump and motor arrangement gives long, trouble-free operation and requires only minimum maintenance. The entire unit is suspended on the end of the discharge pipe. The pumps are completely noiseless in operation.

Some day you're going to argue once too often with those boys about that new plastic tubing.



IMPORTANT FACTS ABOUT CLIMAX STANDBY ENGINES!!

CHOICE OF FUELS—
All models operate with equal efficiency on gas, butane or gasoline.

FAST, EASY STARTING—
Climax engines take over the complete load within seconds after normal utility power fails. If the starting system is manual, you merely press a button on the instrument panel...if automatic, the engine starts immediately.

SIMPLE TO OPERATE—
All instruments and controls are located at the sides of the engines . . . easy to read . . . easy to adjust.

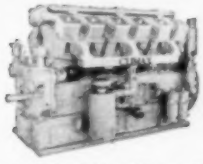
SIMPLE TO MAINTAIN—
Accessories are within "arm's reach" to allow quick inspection and adjustment. Crankcases and engine bases have large hand holes on each side for easy access to all working parts.

SAFETY PROTECTED—
Safety devices are standard equipment on all models and automatically protect the engines against high water temperature and low oil pressure. An overspeed governor can also be furnished, if required.

ACCESSORIES—
Various types of cooling and starting systems, mufflers, etc. are available to make each engine suitable for a particular application.

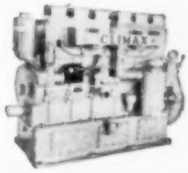
LONG ENGINE LIFE—
Climax engines are constructed of the finest metals, alloys and component parts available. Any model will give years of service if properly maintained.

Write today for complete information, bulletins or engineering consultation

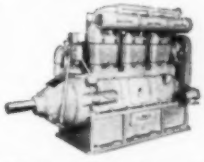


V-125—12 cylinder, 605 max. H.P. at 1200 R. P. M.
V-122—12 cylinder, 520 max. H.P. at 1200 R. P. M.

V-85—8 cylinder, 390 max. H.P. at 1200 R. P. M.
V-80—8 cylinder, 340 max. H.P. at 1200 R. P. M.



K-75—6 cylinder, 302 max. H.P. at 1200 R. P. M.
K-67—6 cylinder, 265 max. H.P. at 1200 R. P. M.



R-165—6 cylinder, 192 max. H.P. at 1200 R. P. M.
R-110—4 cylinder, 130 max. H.P. at 1200 R. P. M.

CLIMAX ENGINE MANUFACTURING CO.
208 South LaSalle Street • Chicago 4, Illinois
Factory—CLINTON, IOWA • *District Office*—DALLAS, TEXAS
In Canada—Canadian Fairbanks-Morse Co., Ltd., Montreal and 16 Branches

Announcing the most revolutionary development

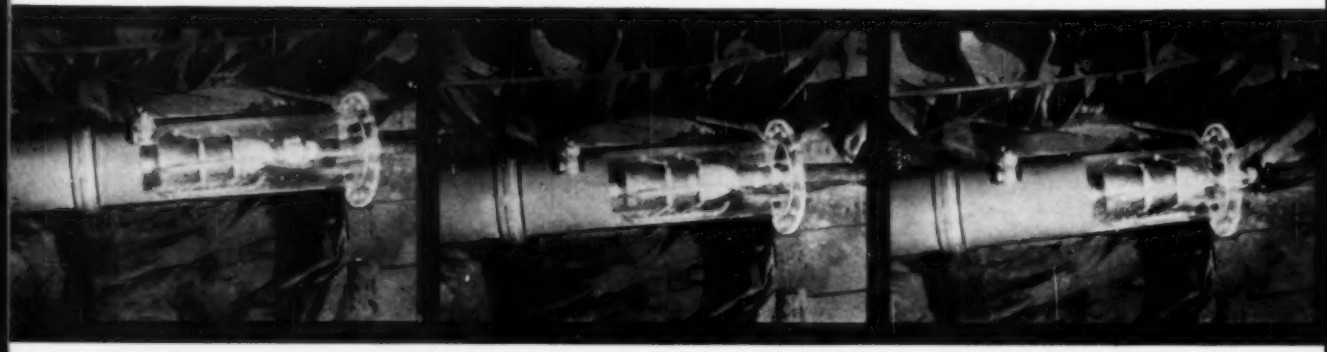
NOW! THE CENTRILINE PROCESS

STRIP PHOTO • TOP: *Cross section view, in special transparent pipe, showing new small size Centriline machine in action being pulled through the pipe from left to right. Note the uniformity of the cement-mortar lining.*

STRIP PHOTO • BOTTOM: *View of machine at work in special cut away pipe illustrating centrifugal application of the cement-mortar.*

in the water works field in the past 15 years!

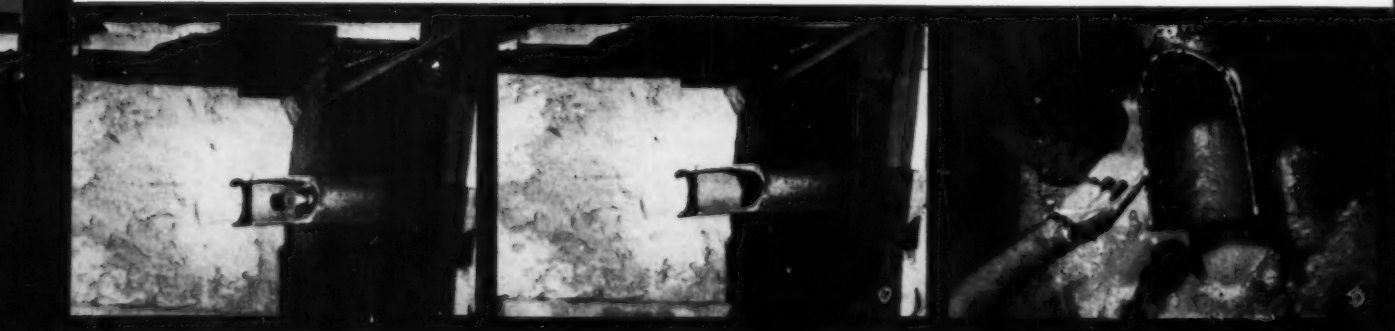
is also available for 6″ to 14″ mains



NOW, for the first time, your city's small but important transmission and distribution lines, including those used for fire protection, can regain their original flow capacity and pressure through the famous Centriline Process. A smaller version of the Centriline machine has been developed for use in 6″ to 14″ mains.

Here is how Centriline rehabilitates water systems' distribution grids. First, the pipes are cleaned to remove all tubercules, scale and loose materials resulting from corrosion. The Centriline machine is placed in the pipe and mortar is forced into a rapidly revolving head which applies a uniform coating on the pipe wall by centrifugal force. The thickness of the lining can be regulated by careful control of the machine. All of this is accomplished with a minimum of interruption to surface traffic, since the pipes are lined in place!

The advantages of using the new, small diameter Centriline machine in your mains are numerous. The new machine has a design feature which eliminates most excavations at valves, laterals and corporation cocks. The cost is lower than ever before. In addition, Centrilining permanently prevents future tuberculation, corrosion or leakage . . . reduces maintenance and pumping costs . . . raises distribution pressures and efficiency and extends the life of steel or cast iron pipe indefinitely. Send today for your free copy of our illustrated booklet which fully describes how Centriline can help you salvage worn out water lines of every size.



CENTRILINE CORPORATION

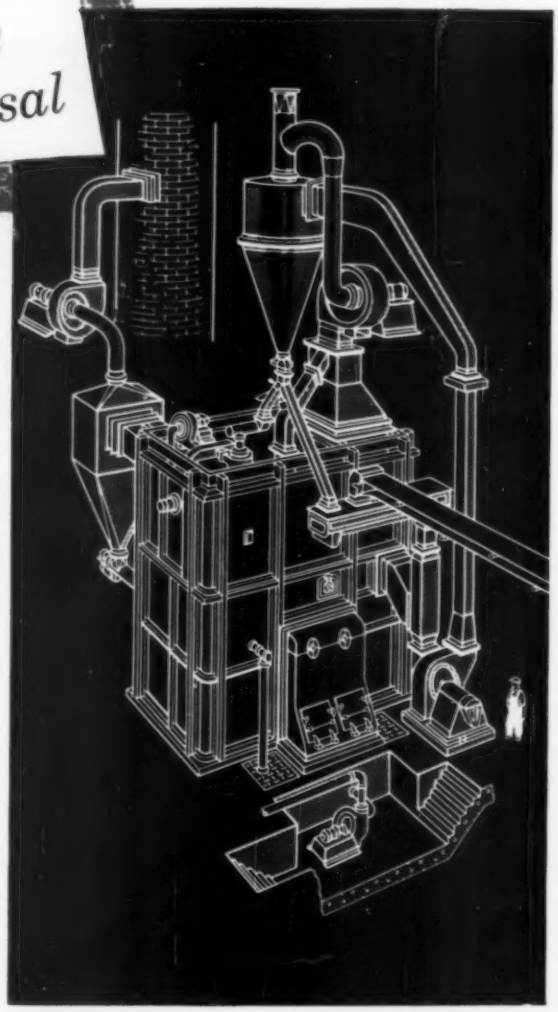
A Subsidiary of Raymond Concrete Pile Company

140 Cedar Street
New York 6, N.Y.
WOrth 2-1429

Branch Offices in Principal Cities of the United States, Canada and Latin America

THE C-E RAYMOND FLASH DRYING SYSTEM...

6 reasons why it's your best choice for sludge disposal



IT OFFERS THESE FUNCTIONS:

1. Drying... Only the C-E Raymond System gives you *controlled* drying. This means that your filter cake is reduced to particles uniform in size...low and uniform in moisture content...highly suitable for use as fertilizer when sludge characteristics permit.

2. Incineration... The Raymond System provides the simplest, most efficient method of sludge incineration. It produces a sterile ash that is free of clinkers...requires less purchased fuel.

3. Deodorizing... The C-E Raymond System is the only one that offers high temperature deodorization to remove foul odors from combustion gases, as well as from sludge holding tanks.

WITH THESE FEATURES:

4. Superior Structure... Instead of relying on multiple refractory arches, the C-E Raymond System utilizes small groups of arch bricks individually hung from steel supports above and outside the furnace. This not only makes arch failure virtually impossible, but permits very rapid start-ups and shut-downs... offering important man-hour and fuel savings.

5. Economical Operation... This system has a proved record of low maintenance costs. Not only is maintenance negligible, but the revenue gained from the sale of flash-dried sludge as fertilizer can help pay the operating costs of your plant.

6. Proved Dependability... More than a quarter of a century of use and development in plants throughout the United States and abroad has shown the capability of the C-E Flash Drying System.

More filter cake is dried and/or burned in this system than by all other systems combined.

For detailed information on the C-E Raymond Flash Drying System, and how it can benefit your community, contact the Combustion office nearest you. A C-E specialist will be glad to discuss your requirements with you or your consultants.

COMBUSTION ENGINEERING

RAYMOND DIVISION, 1315 North Branch Street, Chicago 22, Illinois

Eastern Office: 200 Madison Avenue, New York 16, N. Y. • Western Office: 510 West Sixth Street, Los Angeles 14, Cal.

Canada: Combustion Engineering-Superheater Ltd.

C-E

C-107B

ALSO FLASH DRYING AND INCINERATION SYSTEMS FOR INDUSTRIAL WASTE DISPOSAL

New Bulletins *AVAILABLE FREE*

Primary Elements Catalog
113

Burgess-Manning Co., Penn Instruments Div., Philadelphia, Pa., has just published a 16-page Primary Elements Catalog #1, the first catalog of its kind.

The catalog, which contains listings and data of all forms of primary elements, includes information on orifice plates, flow nozzles, forged and fabricated, and Venturi tubes, cast and fabricated and their accessories.

SK's Instrument Division Products
114

Schutte and Koerting Company, Cornwells Heights, Pa., has announced the publication of Bulletin M-1, a condensed bulletin on Rotameters and Flow Instruments which pictures and briefly describes the division's line of precision instruments for measuring, indicating, recording, and controlling the rate of flow of all types of fluids.

The bulletin includes information on the following products: Rotameters, including general-purpose glass-tube types, armored types for measuring hazardous fluids or fluids under abnormally high pressures, bypass and "T" types for measuring large flows, transmitting types for the remote indicating, recording, or controlling of fluid rate of flow, laboratory and chemical types, alarm types, and small purge units for applications where inexpensive types are needed to indicate and manually control small flows; and Flow Indicators designed for installation in pipe lines where it is necessary to determine, by visual observation, that fluid is flowing in the right direction and in the proper state and condition.

Dual Valve Sludge Pumps
115

Komline-Sanderson Engineering Corp., Peapack, New Jersey, has just released a four-page bulletin on its Diaphragm and Plunger Type-Dual Valve Sludge Pumps.

According to the bulletin, the Dual Valve Sludge Pump has been designed for feeding sewage to vacuum filter installations. The Dual Valve Diaphragm Pump is intended primarily for pumping heavy slurries; such as, lime slurry. The new bulletin contains complete descriptions of both pumps as well as diaphragm and pump selection chart.

Ball Joint Pipe
116

American Cast Iron Pipe Co., Birmingham, Ala., has just published a catalog on the American Molox Ball Joint Pipe.

The catalog is profusely illustrated and contains instructions for assembly, weight and dimension tables and different methods of installing the ball joint pipe for river crossings and submarine service.

Chemicals Used in Water, Sewage and Waste Treatment
117

Omega Machine Co., B-I-F Industries, Providence, R. I., has just released a revised, and up-to-date issue of their Technical Bulletin on Chemicals Used in Water, Sewage and Waste Treatment.

The revised copy of the bulletin, contains pertinent data and information of interest to designing engineers and supervisors of plants where chemicals are used in treatment processes.

The data in this bulletin have been compiled from various publication sources and the files of Omega Machine Co., and represent current information on 52 chemicals used in water purification, sewage and waste treatment.

In addition to a listing of symbols and abbreviations, it contains information on the various chemicals, their formulas, common names, most common uses, forms in which they are obtainable, shipping containers, and characteristics including appearance and properties, bulk density, commercial strength and solubilities.

Feeding recommendations and a table showing where these 52 chemicals are used in water, sewage and waste treatment processes are also included.

CONTINUED ON PAGE 26A

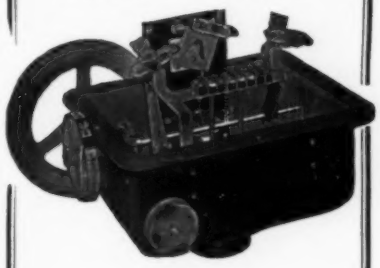
SURE LOCATIONS EVERY TIME!

- **NO WIRES, BATTERIES or SWITCHES**—simple, powerful magnetic action, factory adjusted to YOUR geographical location assures unfailing results!
- **NO NEEDLE SPINNING**—exclusive electric braking action saves you time!
- **NO STOOPING**—easy top-view reading!
- **RUGGED**—compact, accurate, convenient!
- **GUARANTEED**—to function regardless of weather, surface or ground cover!
- **NATION'S MOST WIDELY USED LOCATOR!**
- **15-DAY FREE TRIAL** — No money! No obligation! You be the judge!

ORDER NOW — Wire or call Kirby 1-4200 collect for fastest delivery!

AQUA SURVEY & INSTRUMENT CO.
2020 Leslie Avenue, Cincinnati 12, Ohio

ROTO-TROL



RF-2

WITH ALTO-TROL

This 2-pump RF-2 Roto-Trol assures equal use and wear of both pumps. Each pump is operated on alternate starting cycles.

The RF-2 operates both pumps together, when required. RF-2 installations give dependable service year after year, with the minimum of attention.

Write for full data

WATER LEVEL CONTROLS DIVISION
HEALY-RUFF COMPANY
783 Hampden Ave., St. Paul 4, Minn.

TC
TENNESSEE CORPORATION

1 Manganese and Silical removal
2 Increased filter runs
3 Coagulation over wide pH ranges
4 Rapid floc formation
5 Turbidity removal
6 Economy
7 Color removal
8 Excellent taste and odor control
9 Bacteria removal
10 Ease of Operation

Ferri-Floc
TC Floc
FERRIC SULFATE

The Superior COAGULANT
With The Plus FACTORS—

Ferri-Floc gives smoother, more efficient and trouble free operation. Whatever your particular water treatment problem may be, you can depend on Ferri-Floc doing a superior job and doing it efficiently and economically — Ferri-Floc is a free flowing granular salt which can be fed with few modifications through any standard dry feed equipment. It is only mildly hygroscopic, thereby permitting easy handling as well as storage in closed hoppers over long periods of time.

WATER TREATMENT

Efficient coagulation of surface or well waters. Aids taste and odor control—Effective in lime soda-ash softening. Adaptable to treatment of nearly all industrial waters.

SEWAGE TREATMENT

Ferri-Floc coagulates water and wastes over wide Ph ranges—it provides efficient operation regardless of rapid variations of raw sewage and is effective conditioning sludge prior to vacuum filtration or drying on sand beds.

SULFUR-DIOXIDE HIGHEST QUALITY SO_2

SULFUR-DIOXIDE is effectively used for dechlorination in water treatment and to remove objectionable odors remaining after purification.

COPPER SULFATE will control about 90% of the microorganisms normally encountered in water treatment plants more economically than any other chemical.

COPPER TC SULFATE

FREE BOOKLET
Let us send you without charge, a 38 page booklet that deals specifically with all phases of coagulation—just send us a postal card.

TENNESSEE TC CORPORATION

617-29 Grant Building, Atlanta, Georgia

New Bulletins

CONTINUED FROM PAGE 25A

Pneumatic Sewage Ejectors

118

The Komline-Sanderson Engineering Corp., Peapack, New Jersey has just published a bulletin on its new Pneumatic Sewage Ejector.

According to the bulletin, this system handles flows from 20 to 600 gallons per minute against extremely high heads and is offered in either single or twin units. The new circular contains a compressor capacity selection chart as well as a diagram of the Duplex unit.

Type S Controller

119

Simplex Valve & Meter Co., Lancaster, Pa., has published a comprehensive and well documented 12-page bulletin on the Type S controller. This bulletin will be of interest to engineers, operating and maintenance personnel of municipalities, public works plants, processing industry plants, etc. dealing with water usage and its conservation. Valuable data on details of design, capacities, dimensions, and typical installations are included.

According to the bulletin, controller is a device that can be used to regulate flows of liquids in a line and specifically in filter plants to maintain a uniform rate of filtration through each filter unit. According to the manufacturer, favorable operating conditions are attained by the use of these versatile and highly accurate rate of flow controllers.

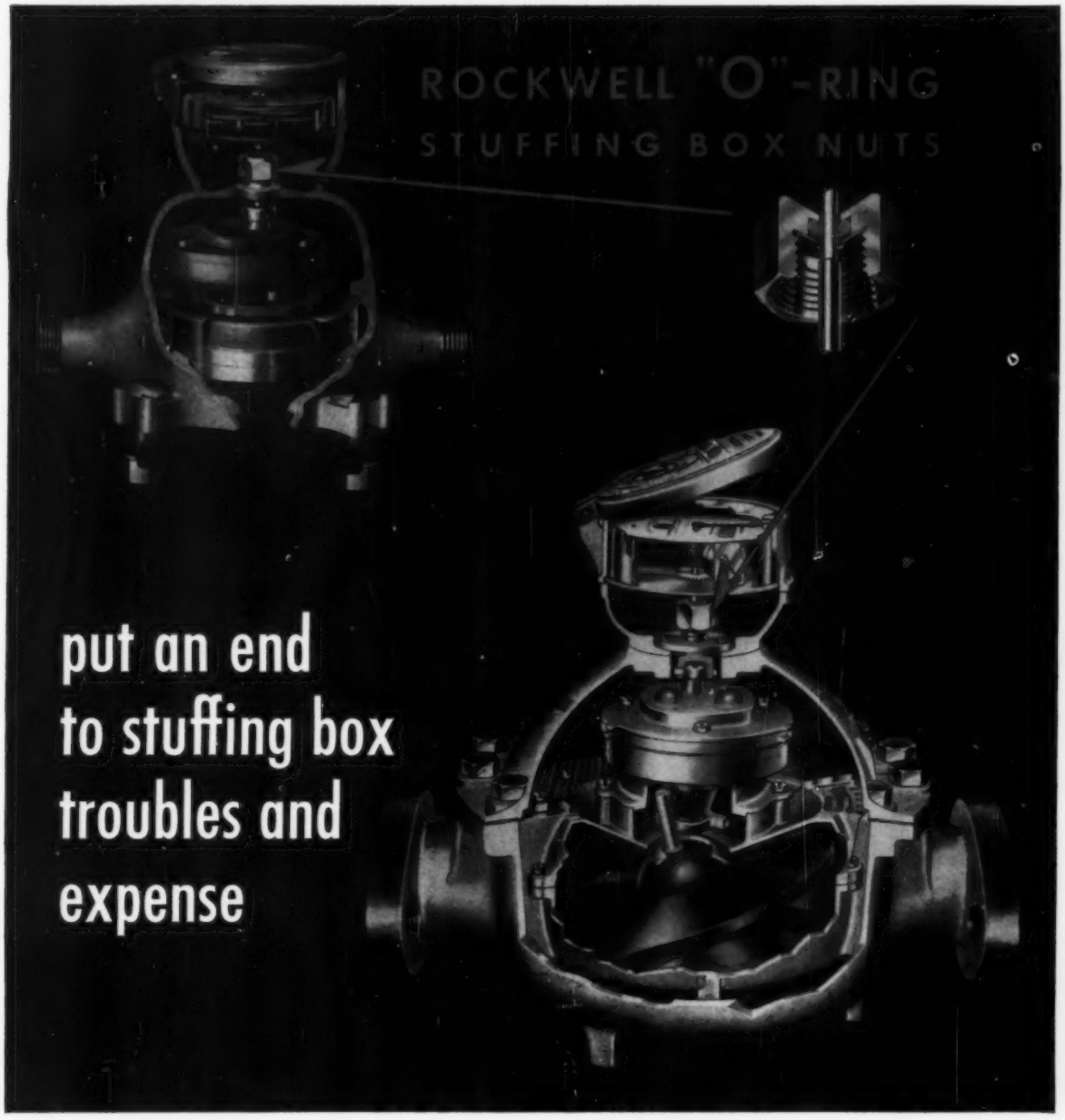
Industrial pH Handbook

120

The Process Instruments Division of Beckman Instruments, Inc., Fullerton, Calif., has announced the availability of **"The Industrial pH Handbook."**

This 80-page handbook is the first manual ever published giving such thorough coverage of industrial pH information under one cover. Compiled and edited by Thomas J. Kehoe, Application Engineering Supervisor, the handbook

CONTINUED ON PAGE 98A



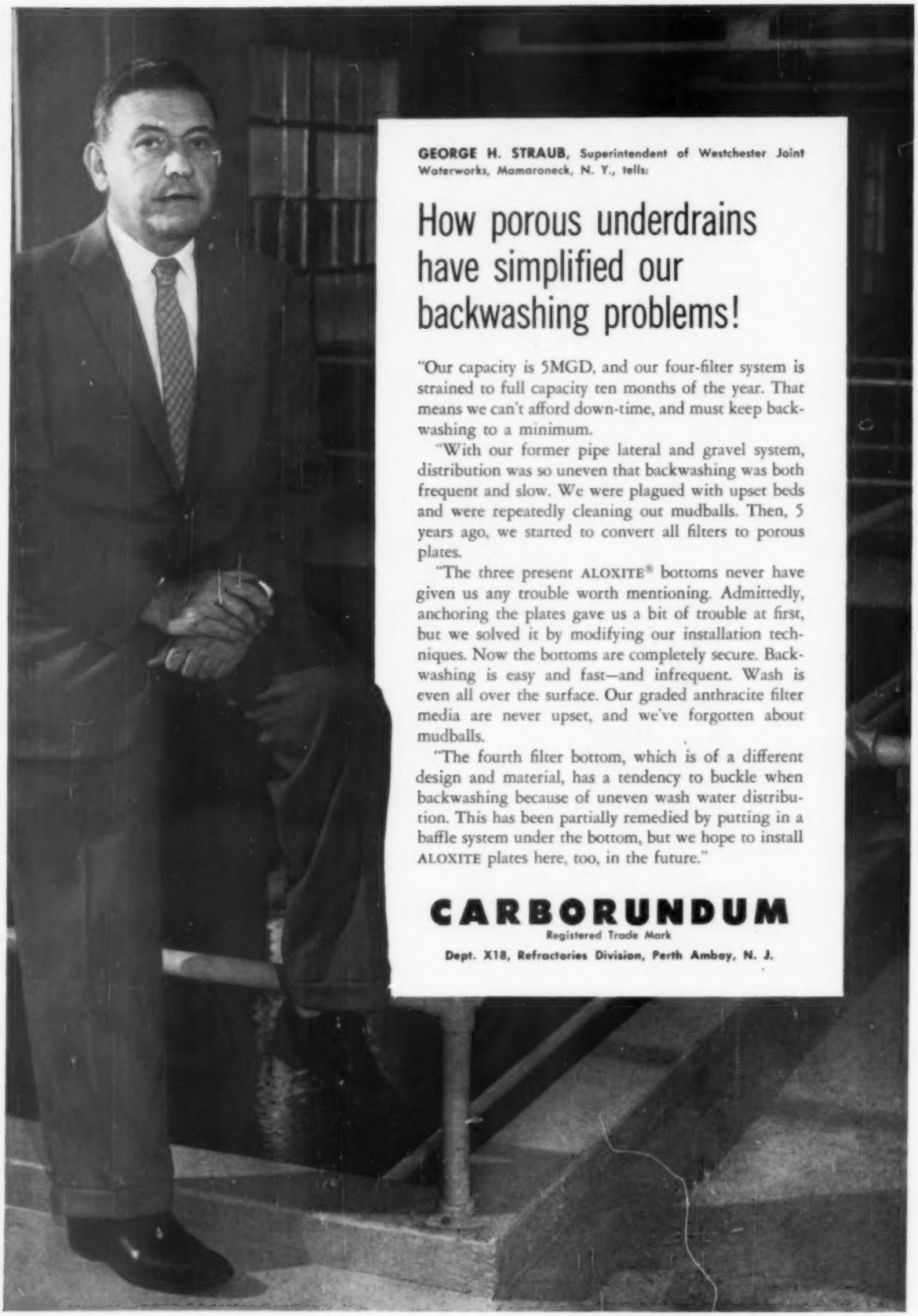
EXCLUSIVE CONSTRUCTION ELIMINATES LEAKS, BINDS*

Rockwell "O"-Ring stuffing box nuts provide a *leak tight seal* on the register drive spindle. This seal is accomplished with *very slight compression*, so friction becomes negligible and meter performance is actually improved. This construction is *foolproof*, since the "O"-Ring nut can be force tightened with a wrench without applying any additional compression.

Seven years of field experience have proved the success of this *exclusive* Rockwell development—now furnished as standard construction on Rockwell meters at no additional cost. And Rockwell "O"-Ring stuffing box nuts are available as interchangeable replacement parts for earlier model Rockwell meters. Ask your Rockwell representative to demonstrate. Rockwell Manufacturing Company, Pittsburgh 8, Pennsylvania.

Patented

WATER METERS
another fine product by
ROCKWELL



GEORGE H. STRAUB, Superintendent of Westchester Joint Waterworks, Mamaroneck, N. Y., tells:

How porous underdrains have simplified our backwashing problems!

"Our capacity is 5MGD, and our four-filter system is strained to full capacity ten months of the year. That means we can't afford down-time, and must keep backwashing to a minimum.

"With our former pipe lateral and gravel system, distribution was so uneven that backwashing was both frequent and slow. We were plagued with upset beds and were repeatedly cleaning out mudballs. Then, 5 years ago, we started to convert all filters to porous plates.

"The three present ALOXITE® bottoms never have given us any trouble worth mentioning. Admittedly, anchoring the plates gave us a bit of trouble at first, but we solved it by modifying our installation techniques. Now the bottoms are completely secure. Backwashing is easy and fast—and infrequent. Wash is even all over the surface. Our graded anthracite filter media are never upset, and we've forgotten about mudballs.

"The fourth filter bottom, which is of a different design and material, has a tendency to buckle when backwashing because of uneven wash water distribution. This has been partially remedied by putting in a baffle system under the bottom, but we hope to install ALOXITE plates here, too, in the future."

CARBORUNDUM
Registered Trade Mark

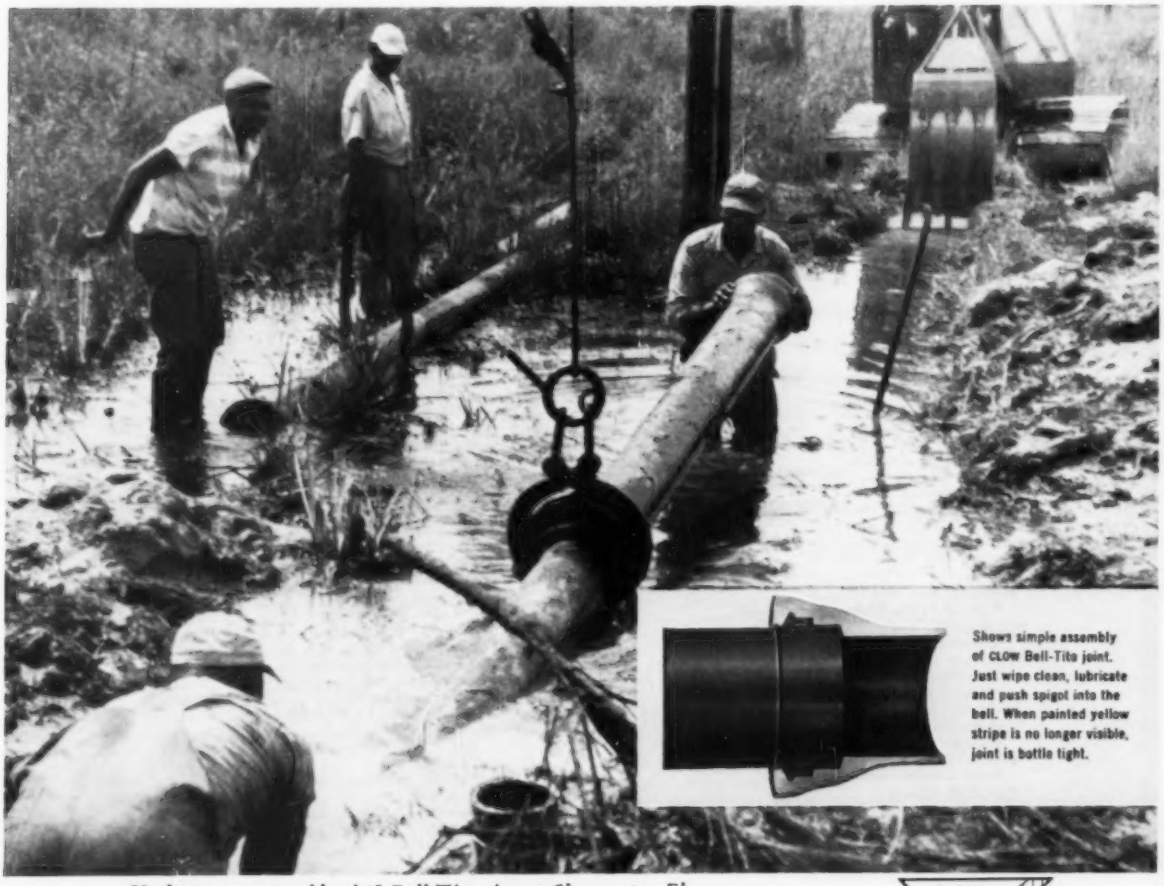
Dept. X18, Refractories Division, Perth Amboy, N. J.

How a Four-Man Crew laid 1500 feet a day of CLOW Bell-Tite® pipe through Florida swampland

CLOW cast iron pipe, with the sensational Bell-Tite joint, proved its advantages conclusively in this Clearwater, Florida, installation.

That a four-man crew was able to lay this CLOW Bell-Tite pipe at 1500 feet a day under these adverse conditions is definite evidence of the time, labor and money-saving advantages of this CLOW-designed joint. Two men worked in the trench—often in 3 feet of water. One man lubricating and aligning the joints, the other assembling with a pinch bar. A crane operator and a hook-up man completed the crew.

CLOW Bell-Tite forms a pressure-tight joint—instantly—no bolts or follower glands required. Under practically all conditions, it is the fastest, easiest and most economical pipe for water main installation. Underwriters' Laboratories Inc. listed in diameters 3- through 24-inch.



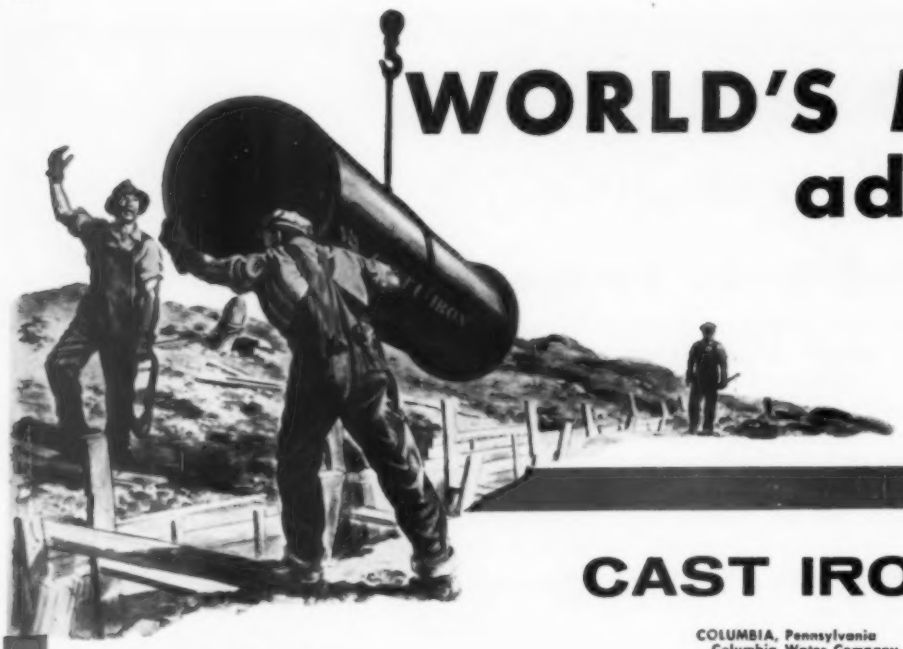
Shows simple assembly of CLOW Bell-Tite joint. Just wipe clean, lubricate and push spigot into the bell. When painted yellow stripe is no longer visible, joint is bottle tight.

Under-water assembly of 8" Bell-Tite pipe at Clearwater, Fla.
Contractor: Hancock Pipe Company, Clearwater, Fla.

JAMES B. CLOW & SONS, Inc.

CLOW 1878

Subsidiaries:
Eddy Valve Company, Waterford, New York
Iowa Valve Company, Oskaloosa, Iowa



WORLD'S MOST adds 20

CAST IRON PIPE

*ADRIAN, Michigan
Citizens Gas Fuel Company

ALBANY, New York
Dept. of Water and Water Supply

ALBANY, New York
Niagara Mohawk Power Corp. (Gas)

ALEXANDRIA, Virginia
Alexandria Water Company

ALLENTOWN, Pennsylvania
Bureau of Water

*ALTON, Illinois
Union Electric Company, Gas Division

ATLANTA, Georgia
Atlanta Gas Light Company

BALTIMORE, Maryland
Bureau of Water, Dept. of Public Works

BALTIMORE, Maryland
Baltimore Gas and Electric Company

*BANGOR, Maine
Citizens Utilities Company, Gas District

*BETHLEHEM, Pennsylvania
The United Gas Improvement Company

BOSTON, Massachusetts
Public Works Dept., Water Division

BOSTON, Massachusetts
Boston Consolidated Gas Co.

BOUND BROOK, New Jersey
Public Service Electric & Gas Co.

BRIDGEPORT, Connecticut
Bridgeport Gas Light Company

BUFFALO, New York
Dept. of Public Works, Div. of Water

*CAMBRIDGE, Massachusetts
Cambridge Water Board

*CARLISLE, Pennsylvania
The United Gas Improvement Co., Gas Division

*CATASAUQUA, Pennsylvania
The United Gas Improvement Company

*CHAMBERSBURG, Pennsylvania
Borough of Chambersburg, Gas Department

CHARLESTON, South Carolina
South Carolina Electric & Gas Co.

CHICAGO, Illinois
Peoples Gas Light & Coke Company

CHICAGO, Illinois
Water Works Department

CINCINNATI, Ohio
Cincinnati Gas & Electric Co.

COLUMBIA, Pennsylvania
Columbia Water Company

DETROIT, Michigan
Board of Water Commissioners

DETROIT, Michigan
Michigan Consolidated Gas Co.

ELIZABETH, New Jersey
Elizabethtown Consolidated Gas Co.

EVANSVILLE, Indiana
Southern Indiana Gas & Electric Co.

FALL RIVER, Massachusetts
Fall River Gas Works Company

FREDERICK, Maryland
City of Frederick Water Dept.

FREDERICK, Maryland
Frederick Gas Company, Inc.

CITY OF FREDERICKSBURG, Virginia
Gas Department

*HAGERSTOWN, Maryland
Hagerstown Gas Company

HALIFAX, Nova Scotia
Public Serv. Co., Public Water Supply

*HARRISBURG, Pennsylvania
The United Gas Improvement Co., Harrisburg Gas Div.

HARTFORD, Connecticut
The Hartford Gas Company

HARTFORD, Connecticut
Water Bureau, Metropolitan District

HUNTSVILLE, Alabama
Municipal Water Works

INDIANAPOLIS, Indiana
Citizens Gas & Coke Utility

KNOXVILLE, Tennessee
Knoxville Utilities Board (Gas)

*LAMBERTVILLE, New Jersey
City Gas Company

LANCASTER, Pennsylvania
Bureau of Water

LOUISVILLE, Kentucky
Louisville Gas & Electric Co.

LYNCHBURG, Virginia
City of Lynchburg Water Dept.

MADISON, Indiana
Natural Gas Service, Inc.

MEDIA, Pennsylvania
Philadelphia Electric Company Gas Dept.

MINERSVILLE, Pennsylvania
Municipal Authority, Borough of Minersville

MOBILE, Alabama
Mobile Gas Service Corp.

CAST IRON PIPE

UNUSUAL CLUB new members

The Cast Iron Pipe Century Club . . . Membership in this distinguished Club is restricted to water and gas supply systems still serving their communities through cast iron mains laid a hundred years ago . . . and more!

The Club's unique Honorary Certificate is earned only through performance. It is a tribute to the service supplied by these companies and to the carrier that enabled them to earn it . . . world's most dependable pipe . . . cast iron!

CENTURY CLUB

MOBILE, Alabama
Mobile Water Works Company

MONTREAL, Quebec
Quebec Hydro-Electric Commission

MONTREAL, Quebec
Public Works Dept., Water-Works & Sewerage Division

*MOUNT HOLLY, New Jersey
The Mount Holly Water Company

*NANTUCKET, Massachusetts
Nantucket Gas & Electric Company

NASHUA, New Hampshire
Pennichuck Water Works

NASHVILLE, Tennessee
Waterworks Department

NEW BRUNSWICK, New Jersey
Public Service Electric & Gas Co.

*NEWBURGH, New York
Water Department

NEW HAVEN, Connecticut
New Haven Gas Company

NEW ORLEANS, Louisiana
New Orleans Public Service Inc. (Gas)

NEWARK, New Jersey
Public Service Electric & Gas Co.

*NEW YORK, New York
Consolidated Edison Company of N. Y., Inc., Gas Div.

NEW YORK, New York
Dept. of Water, Gas & Electricity

NORRISTOWN, Pennsylvania
Philadelphia Electric Co., Gas Dept.

*NORWICH, Connecticut
Department of Public Works, Gas Division

*OTTAWA, Ontario
Ottawa Gas

PAINESVILLE, Ohio
City of Painesville, Gas Distribution Dept.

PEORIA, Illinois
Central Illinois Light Company

PHILADELPHIA, Pennsylvania
Dept. of Public Works, Bureau of Water

PHILADELPHIA, Pennsylvania
Philadelphia Gas Works Co.

PITTSBURGH, Pennsylvania
Bureau of Water, Dept. of Public Works

PLYMOUTH, Massachusetts
Plymouth Gas Light Company

POTTSVILLE, Pennsylvania
Pottsville Water Company

*POUGHKEEPSIE, New York
Central Hudson Gas & Electric Corporation, Gas Division

PROVIDENCE, Rhode Island
Providence Gas Company

QUEBEC, Quebec
Quebec Power Co., Gas Division

READING, Pennsylvania
Bureau of Water

RICHMOND, Virginia
Department of Public Utilities (Gas)

RICHMOND, Virginia
Dept. of Public Utilities (Water)

ROCHESTER, New York
Rochester Gas & Electric Corp.

SACRAMENTO, California
Division of Water & Sewers

ST. JOHN, New Brunswick
Water & Sewerage Department

ST. LOUIS, Missouri
Dept. of Public Utilities, Water Div.

SALEM, Massachusetts
North Shore Gas Company

*SANDUSKY, Ohio
The Ohio Fuel Gas Company

SAVANNAH, Georgia
South Atlantic Gas Company

SPRINGFIELD, Illinois
Central Illinois Light Company

SYRACUSE, New York
Water Div., Dept. of Engineering

TORONTO, Ontario
The Consumer's Gas Co. of Toronto

TROY, New York
Department of Public Works

UTICA, New York
City of Utica, Board of Water Supply

*WASHINGTON, D. C.
Washington Gas Light Company

WHEELING, West Virginia
City of Wheeling Water Department

WILLIAMSPORT, Pennsylvania
Williamsport Municipal Water Authority

WILMINGTON, Delaware
Wilmington Water Department

WINCHESTER, Virginia
Water Department

WINSTON-SALEM, North Carolina
Water Department

YORK, Pennsylvania
York Water Company

ZANESVILLE, Ohio
Water Department

*New members in 1957

RESEARCH ASSOCIATION

CAST IRON

THOMAS F. WOLFE, MANAGING DIRECTOR

SUITE 3440, PRUDENTIAL PLAZA, CHICAGO 1, ILLINOIS

CLYDE R. HARVILL,
Superintendent,
San Jacinto Water System,
City of Houston
Utilities Dept.

The Houston Water Purification Plant was one of the first plants to use rubber-seated butterfly valves in filter service. Freese, Nichols and Turner, Consulting Engineers, chose R-S Rubber-Seated Butterfly Valves over conventional gate valves for all low-pressure service because their compact design permitted close coupling of pipe. Result: a substantial saving in space, and a direct, in-place cash saving of $124,000.

Houston, Texas, Reports: COMPLETELY SATISFIED WITH R-S BUTTERFLY VALVE OPERATION

When the Houston Purification Plant went into operation in 1954, 65 R-S Rubber-Seated Butterfly Valves were used to equip the entire low pressure system. Today, Mr. Harvill reports that these valves are giving good service, and that he is fully satisfied with their performance and minimum maintenance requirements during their first years of operation.

R-S Rubber-Seated Butterfly Valves are easy to operate, and will provide 100% effective shut-off with a 125-pound pressure drop. Wedging action of the vane against the tough, flexible rubber seat assures positive closure, even around shaft bosses. The special composition of rubber and other materials gives long wear and resistance to the abrasive action of material flow.

To obtain complete information on the full SMS line – Butterfly Valves, Rotovalves and Ball Valves – see our local representative, or write S. Morgan Smith Company, York, Penna.

S. MORGAN SMITH HYDRODYNAMICS

AFFILIATE: S. MORGAN SMITH, CANADA, LIMITED, TORONTO

1

Rotovalves • Ball Valves • R-S Butterfly Valves • Free-Discharge Valves • Liquid Heaters • Pumps • Hydraulic Turbines & Accessories

AMERICAN Fastite® JOINT* CAST IRON PIPE

Now—another important AMERICAN development—a superior *double-sealing* gasket type joint—American Fastite! This new *field-tested* joint brings installation time and labor costs to new lows! The exclusive *double-sealing*, dual-density rubber gasket and the scientifically designed gasket recesses permit faster, more simple installation—allow liberal deflections—provide positive sealing under low or high pressures! Get full information about the American Fastite joint today—discover for yourself the advantages available only with American Fastite Joint* Cast Iron Pipe.

EXCLUSIVE DOUBLE-SEALING, DUAL-DENSITY RUBBER GASKET!

1 Hard rubber end provides a strong shoulder for self-centering and locking—a permanent seal against cold flow under pressure, fully protected against deterioration.

2 Softer large end for positive compression, liquid-tight sealing and easy assembly.

Tests prove either hard or soft rubber section **alone** provides a positive seal.

Ask your American Cast Iron Pipe Company representative about the unique advantages of this superior **double-sealing** single gasket joint—American Fastite—or write today for a free descriptive brochure.

**Patent applied for—Underwriters Laboratories, Inc. approved.*

AMERICAN CAST IRON PIPE CO.
BIRMINGHAM 2, ALABAMA

SALES OFFICES
New York City • Chicago
Kansas City • Minneapolis
Dallas • Denver • Orlando
Los Angeles • Pittsburgh
San Francisco • Cleveland

Calgon† provides a simple, effective and economical solution to these and many other water problems. Fed at rates of only a few parts per million, Calgon stabilizes iron and manganese dissolved in water, prevents iron pick-up from pipes. Where water meter stoppage or Red Water presents a problem—Calgon is the answer.

Corrosion Control with Calgon is effective in minimizing tuberculation. Mains and pipes stay clean, keeping flows high and pumping costs low.

Calgon also inhibits the formation of lime scale in both naturally hard and lime softened waters. Filters, valves, mains, heaters and meters are kept clean, because Calgon keeps scale forming minerals in solution.

Years of experience with water problems of all kinds in every part of the country are available to you. A phone call or letter will put Calgon's technical know-how to work on your particular problem.

*Calgon is the Registered Trade Mark of Hagan Chemicals & Controls, Inc. for its glassy sodium phosphate products.

†Fully licensed for use under U. S. Patents 2,337,856, 2,358,222 and 2,304,850.

CALGON COMPANY

A DIVISION OF **HAGAN** CHEMICALS & CONTROLS, INC.
HAGAN BUILDING, PITTSBURGH 30, PENNSYLVANIA
DIVISIONS: CALGON COMPANY · HALL LABORATORIES

OVER A HUNDRED YEARS OLD...

"...in good working order"

CITY OF ALBANY, N. Y.

DEPARTMENT OF WATER AND WATER SUPPLY

WILLIAM F. DEVANE
COMMISSIONER

JOSEPH M. LAPENIS
DEPUTY COMMISSIONER

THOMAS F. FITZSIMMONS
SUPERINTENDENT
METERS AND ASSESSMENTS

JOHN C. MCDONALD
CASHIER

October 25, 1957

Eddy Valve Company
Waterford, New York

Gentlemen:

We are enclosing a picture of a 6" Eddy Valve placed in service some time previous to the year 1851, this being the year the City acquired the Water Supply from a private company.

How many years prior to 1851 this valve was installed is problematical as Cast Iron water mains have been used in this city since the year 1813.

This valve is in the distribution system and is in good working order. In checking over a report of George W. Carpenter, Superintendent of the City Water Works, dated January 16, 1854, we find that valves at that time were called stop cocks.

We thought perhaps you would be interested in knowing about your product.

Very truly yours,

William F. Devane
Commissioner

WFD:k

EDDY valves and hydrants not only give the kind of service that Albany's Water Commissioner William F. Devane tells us about—but Eddy can supply repair parts for any and every valve they ever built.

It is important that future long-time service is a part of what you buy. When your municipality embarks on a waterworks modernization program make sure that the capacity and resources of your equipment supplier are such as to assure its maintenance—even for a hundred years.

That's why Eddy is a good company to do business with. Let us give you the facts and figures.

EDDY AWWA fire hydrants offer these advantages

They open smoothly with the pressure, close without water hammer. Entire operating mechanism is easily removed for inspection and repair *by one man.* Standpipe drains by automatic drip action.

EDDY has everything you need for underground water systems

Quickly available are AWWA gate valves, cutting-in valves and sleeves, tapping valves and sleeves. Call your EDDY man for complete details.

EDDY VALVE COMPANY
A Subsidiary of James B. Clow & Sons, Inc.

WATERFORD NEW YORK

You'll see a demonstration of the completely revolving head. The entire head or nozzle section can be faced in any direction with none of the restrictions imposed by ordinary flanges. All that is necessary is to loosen the bolts in the flange.

We'll be glad to show you the R. D. Wood Swivel Joint Hydrant right in your office

We'll show you the optional breakable flange and stem coupling which permit quick repair and thus give the community better fire protection—and you won't have to get out of your office chair!

We mean a scale working model, of course, about 2 feet high and accurate down to the last nut and bolt. As we take it apart for you, you will see quite clearly the hydrant's sound, simple construction, the smoothly rounded changes in diameter which reduce friction and deliver water at full pressure.

It's a really reliable hydrant. Like to see it? Write us today for a demonstration.

R. D. WOOD COMPANY

Public Ledger Building, Philadelphia 5, Pa.

Manufacturers of "Sand-Spun" Pipe (centrifugally cast in sand molds) and R. D. Wood Gate Valves

"Our Crew Laid Over 200 Feet of 54" I.D. Cen-Vi-Ro Bell and Spigot Sewer Pipe the First Working Day!"

It's easy to install Cen-Vi-Ro Concrete Pipe

Here's Proof! A crew from Harbert Construction Corporation, Birmingham contractor, in its first experience with Cen-Vi-Ro Bell & Spigot rubber gasket Sewer Pipe, laid over two hundred feet of 54" diameter pipe the first eight-hour working day!

J. W. Goodwin Engineering Company, Birmingham, Alabama, were engineers on this job. It called for 630 feet of Cen-Vi-Ro Concrete Sewer Pipe, Teckote lined, as part of the Jefferson County Sewage Trunk Line, under the expanding Birmingham CAA Municipal Airport.

Cen-Vi-Ro Bell & Spigot Pipe with rubber gaskets is available in 12" to 54" diameters. Cen-Vi-Ro Concrete Pipe's longer, faster-laying lengths, easier, faster handling and fewer joints mean extra stability and lower labor costs.

Write today for the complete story on the many other advantages of Cen-Vi-Ro Concrete Pipe.

THE NAME ITSELF MEANS THE WORLD'S FINEST CONCRETE PIPE!

CEN-VI-RO

Comes from **Centrifugally** spinning dry, "earth-moist" mixture fed into form in uniform layers.

comes from **Vibration** of spinning form during charging. Special vibrator-tampers do this job.

comes from **Rolling** mixture under great pressure, applied by specially designed steel roller.

Vulcan Materials Company

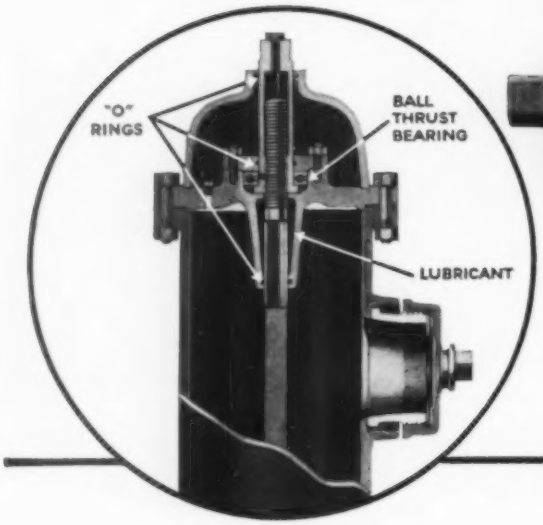
"Organized for Service"

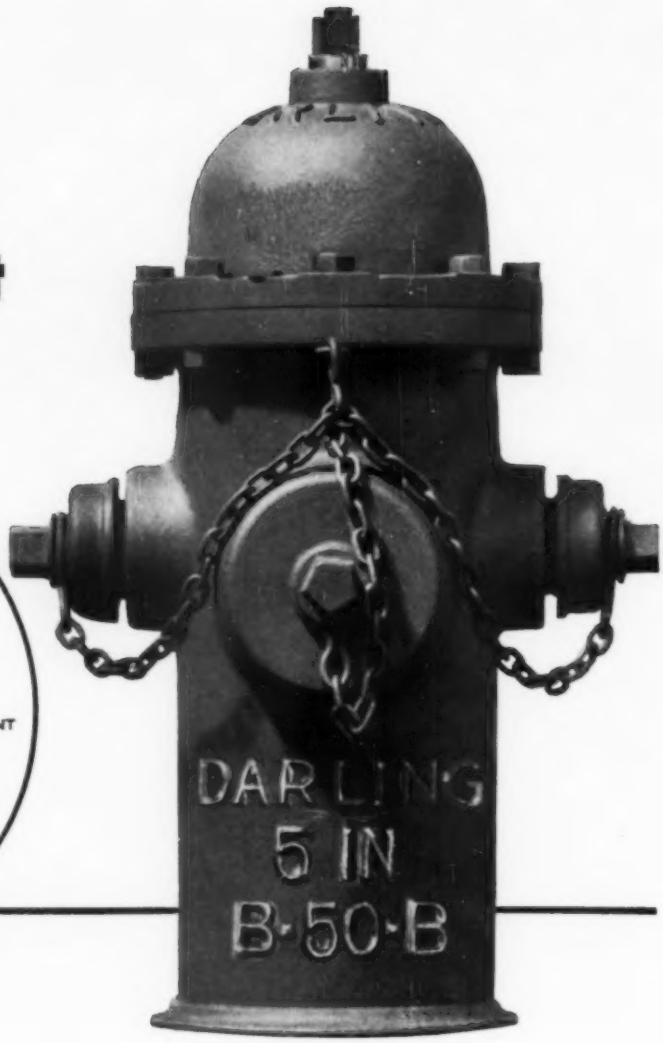
A Subsidiary of the Vulcan Materials Company

Southern CEN-VI-RO PIPE CORPORATION

Post Office Drawer 155 • Birmingham, Alabama

Trouble hasn't a chance!





with **DARLING B-50-B** hydrants

TAKE a good close look at the Darling B-50-B design—*the new ball bearing operated, packless, dry-top hydrant with "O" ring seals*—and you'll see what we mean!

With this hydrant there's no concern about the maintenance or failure of packing, because there isn't any packing! Moreover, water can't get to the operating threads to cause corrosion or contaminate the lubricant. And, just as the water stays *out*, protective thread and bearing lubricant stays *in*. Likewise, at the main valve, Darling's positive, multi-port drainage and automatic flushing gives unmatched protection against freeze-ups.

That's not all. Ball bearing design cuts needed operating torque in half . . . all of which adds up to the smoothest, fastest, surest hydrant performance known today.

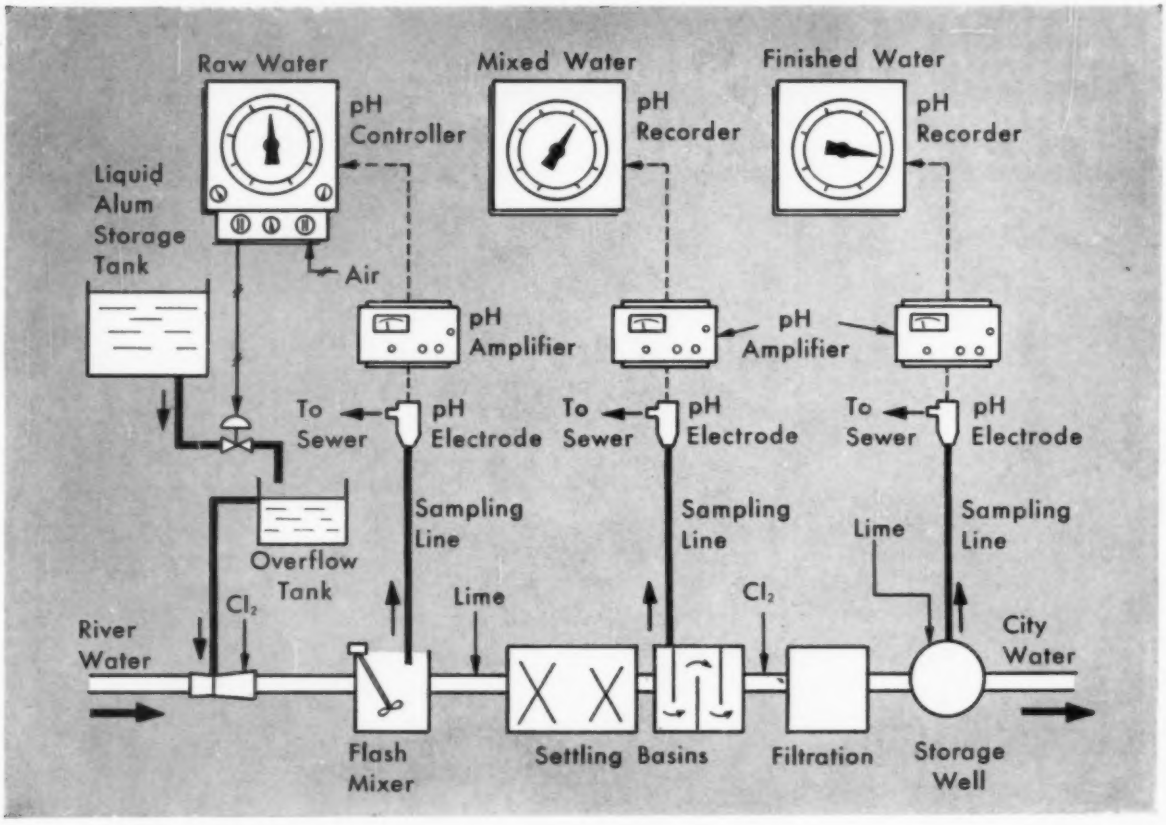
So there's good reason to make Darling B-50-B hydrants *your* first choice. They are made in a wide range of standard types and sizes for any requirement you can name. Write for Bulletin 5710.

TRADE DARLING MARK

DARLING VALVE & MANUFACTURING COMPANY

Williamsport 11, Pa.

Manufactured in Canada by The Canada Valve & Hydrant Co., Ltd., Brantford 7, Ont.



Capacity doubled, chemical costs halved

. . . *with* HONEYWELL *controls at Macon Water Works*

Brown ***ElectroniK*** pH instruments cut chemical costs by 50 percent, double filtration capacity, and save 200,000 gpd of blow-off water at Macon Water Works.

Treating water of high turbidity and high suspended solids content is no longer a problem at the Macon, Ga. Water Works. With the replacement of a manually-regulated chemical feed system by Honeywell automatic controls, alum and chlorine consumption is reduced by half. These controls reduce turbidity from nine to 1.5 parts per million, doubling filter plant capacity. Red water is eliminated, with a saving of more than 200,000 gpd in blow-off water. Honeywell instrumentation has paid for itself within the first year of operation.

The installation consists of three *ElectroniK* pH instruments. One recorder-controller measures and maintains the pH of water in the flash mixer at the most efficient coagulation value, by automatically adding liquid alum to raw water. The other two instruments measure and record pH of treated and finished water.

For the economical solution to your own water treatment problems, call your nearby Honeywell sales engineer. He's as near as your phone.

MINNEAPOLIS-HONEYWELL REGULATOR CO., *Industrial Division*, Wayne and Windrim Aves., Phila. 44, Pa.—in Canada, Toronto 17, Ontario.

MINNEAPOLIS **Honeywell**

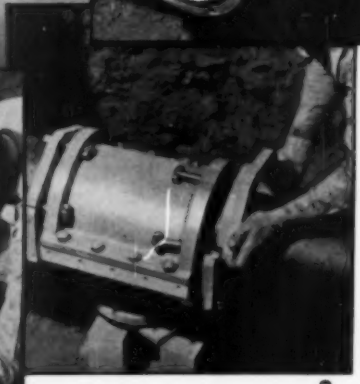
BROWN INSTRUMENTS

First in Controls

THE ANSWER TO PRESSURE CONNECTIONS

5

4



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SMITH MECHANICAL JOINT TAPPING SLEEVES AND VALVES

Installing Smith Mechanical Joint Tapping Sleeves and Valves is the up-to-date way to make connections, sizes 2″ and larger under pressure. Installation can be speedily completed in any weather, even in wet excavations. The only tools required are two wrenches. Here's how: (1) Clean pipe — position and bolt sleeve halves on pipe. (2) Position and press gaskets into sleeve ends until evenly seated. (3) Attach split follower rings and hand tighten bolts and nuts. (4) Locate sleeve with outlet flange in desired position — tighten follower ring bolts and nuts. (5) Tighten side flange gasket compression screws — attach tapping valve. The installation is complete and ready for tapping.

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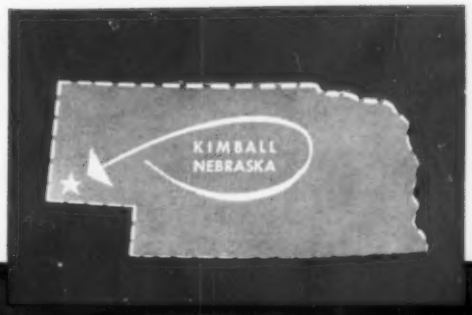
FIRE HYDRANTS · VALVES · SINCE 1896

THE A.P. SMITH MFG. CO.

EAST ORANGE, NEW JERSEY

Kimball's power plant saves $58,000 yearly!



powered by . . .

SUPERIOR DUAL-FUEL ENGINES

Six years ago, fast-growing Kimball, Nebraska decided to modernize its inadequate power plant. Today, powered by three Superior Dual-Fuel Engines, Kimball's power plant is saving $58,000 a year over private utility rates. The engines operate with natural gas at an average cost of 6.93 mills per KWH. On diesel fuel alone power costs are 10 mills per KWH, and annual savings would be $35,000.

The first engine paid for itself in savings in less than three years! Repeat orders later demonstrated the confidence of Kimball city fathers in Superior engine quality. As a further bonus, the three engines are expected to give good service for 35 to 40 years, according to the town's Public Works Director.

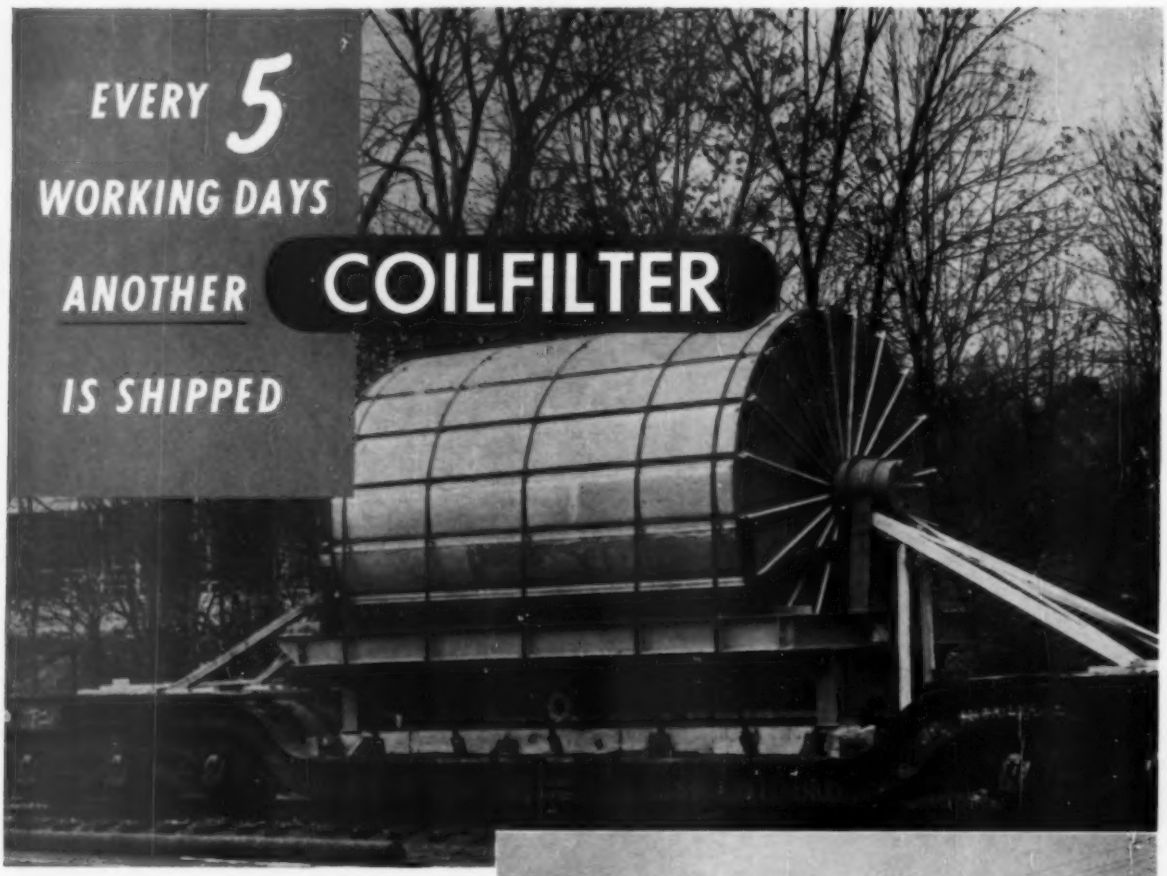
Such *savings*, *satisfaction* and long-term *service* are characteristic of White's Superior engines. See how you can participate in "Kimball-type" savings. Call or write the nearest office listed below. Let White's engineers discuss the new features of Superior and Atlas engines, ranging from 100 to 2150 H.P., for power to 1500 KW.

White Diesel

WHITE DIESEL ENGINE DIVISION

THE WHITE MOTOR COMPANY Plant and General Offices: Springfield, Ohio

SALES AND SERVICE POINTS: Ketchikan, Alaska • San Francisco, Terminal Island, California • Denver, Colorado • Washington, D. C. • Clearwater, Florida • New Orleans, Louisiana • Boston, Mass. • Park Rapids, Minnesota • Webster Groves, Missouri • Callaway, Nebraska • New York, New York • Portland, Astoria, Oregon • Ft. Worth, Houston, Texas Seattle, Wash. • Halifax, Nova Scotia • Vancouver, B. C.



The continued widespread acceptance of the Komline-Sanderson permanent filter media COILFILTER has accelerated manufacturing production rates to the point that for more than three years a COILFILTER unit has been shipped from the Komline-Sanderson plant at the average rate of once a week.

The 11'6" x 16' COILFILTER shown above is the first of three 575 sq. ft. units being shipped to Warren, Michigan, for dewatering fresh sludge.

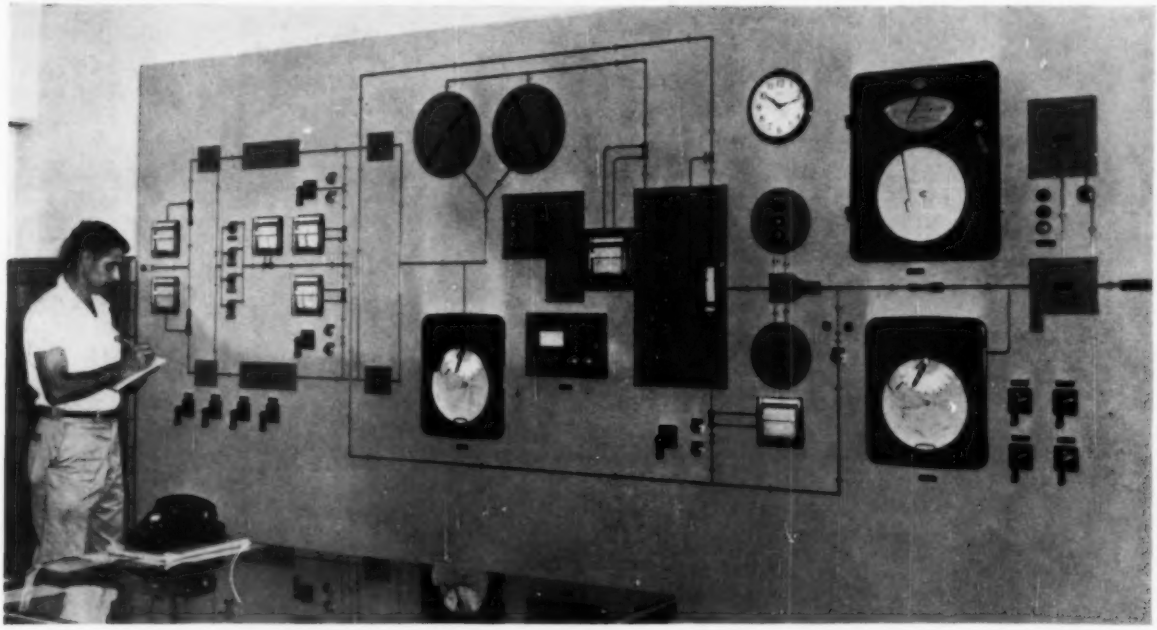
Three large COILFILTER UNITS leaving the plant at Peapack en route to installation at Louisville, Kentucky.

Write for the new 16 page Bulletin No. 106.
"THE COILFILTER STORY"

KOMLINE-SANDERSON ENGINEERING CORPORATION
Peapack, New Jersey

MANUFACTURERS OF COILFILTER SLUDGE VACUUM FILTERS

NEW MUNICIPAL SEWAGE PLANT HANDLES HIGH B.O.D. EFFICIENTLY



. . . with Foxboro Centralized Control

Strong textile wastes mixed with domestic sewage create a difficult treatment problem for the Northside Waste Treatment Plant of the city of Durham, N. C. Raw waste, averaging as much as 600 p.p.m. B.O.D., must be made safe for discharge into a small stream. To do the job with highest efficiency and economy, the plant utilizes a dual treatment process under Foxboro Centralized Control . . . produces an effluent B.O.D. of from 12 to 30 p.p.m. And a Foxboro Graphic Control Panel keeps the entire operation before the eyes of a single operator!

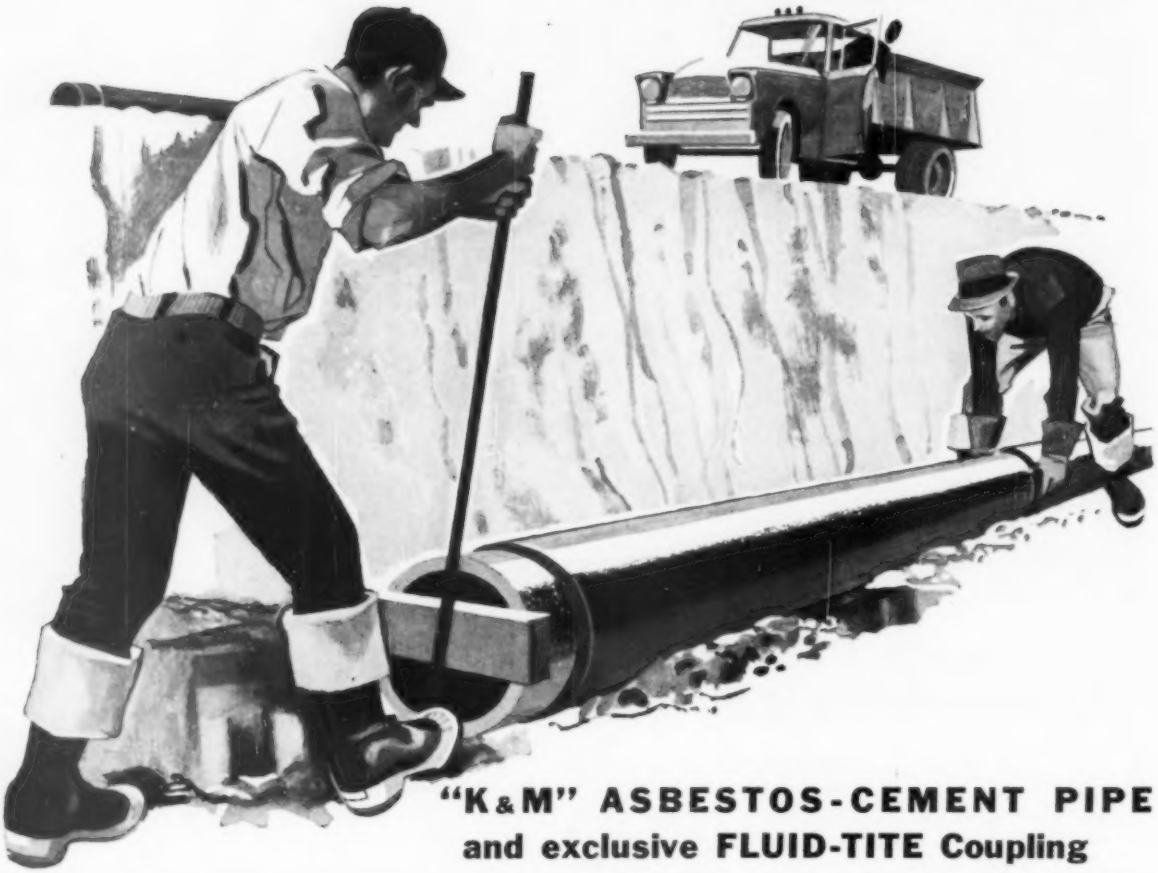
In addition to providing the highly accurate and efficient centralized control that this modern plant requires, plant officials cite the additional help the Foxboro Graphic Panel affords in training personnel and explaining operations to visitors. It's a typical example of the many waste treatment problems successfully solved by Foxboro Instrumentation. Get similar efficiency and economy in your operation. **Write The Foxboro Company, 891 Neponset Ave., Foxboro, Mass.**

High B.O.D. of influent necessitates dual treatment at the Northside Waste Treatment Plant, Durham, N. C. — first with recirculating high-rate trickling filters, then with activated sludge. The Foxboro Graphic Panel (above) keeps all vital operating data constantly before one operator. Foxboro Instruments on panel measure: pH of influent and of trickling filter effluent; flow to filters; plant effluent flow; and return and waste sludge flow. *Consulting Engineers: Piatt and Davis, Durham, N. C.*

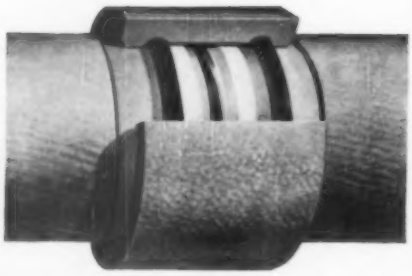
FOXBORO
REG. U. S. PAT. OFF.

INSTRUMENTATION for WASTE TREATMENT

THE MODERN PIPE JOINS TIGHT IN RAIN OR SHINE



"K&M" ASBESTOS-CEMENT PIPE and exclusive FLUID-TITE Coupling



Exclusive sealing rings are the secret of the "K&M" FLUID-TITE Coupling installed with "K&M" Asbestos Pipe. All "K&M" couplings and pipe are hydrostatic pressure-tested to 3½ times the rated operating pressure!

No need to wait for dry skies or a dry trench before installing "K&M" Asbestos-Cement Pipe. Wherever water is to be piped under pressure, "K&M" Pipe is the modern answer. The exclusive FLUID-TITE® Coupling makes installation quick, easy—and permanent.

No special equipment; little skill needed. Just two easy steps: 1. Lubricate rubber rings; 2. Slide pipe into coupling. It is watertight immediately. The FLUID-TITE Coupling allows deflection up to 5° at each joint. Installation and maintenance costs go down when you specify the *modern* pipe and coupling . . . "K&M."

Meets specifications. "K&M" Pressure Pipe meets A.W.W.A., A.S.T.M., and U.S. Federal Specifications, and has Underwriters' Laboratories approval for all sizes (pipe and couplings) in Class 150.

Learn the advantages of the *modern* pipe from the K&M distributor. Or write to us for complete information, including a Flow Chart for "K&M" Pipe based on the Williams and Hazen formula.

KEASBEY & MATTISON
COMPANY • AMBLER • PENNSYLVANIA

K·M
BEST IN ASBESTOS

■ Cut-In Sleeve and Valve installed in main

MUELLER®
cut-in sleeves and valves

Install needed control valves without breaking pipe joints!

■ New control valves can be added and old valves replaced quickly with Mueller Cut-In Sleeves and Valves. Only a minimum of excavation is necessary. You don't have to uncover several lengths of pipe so that pipe joints may be broken. You can install the valve right where you want it — anywhere on the pipe length.

Special mechanical joints on both sleeve and valve permit one Cut-In Sleeve and Valve of a nominal size to be used on any cast iron pipe regularly found in water distribution systems by using the proper end gaskets.

Mueller Cut-In Valves have the same quality features as the Mueller AWWA Gate Valve — including the 4-point-contact wedging mechanism. "O" ring stem seals or conventional packing are optional. Indicator post type cut-in valves are also available. Sizes 4", 6", 8", 10" and 12".

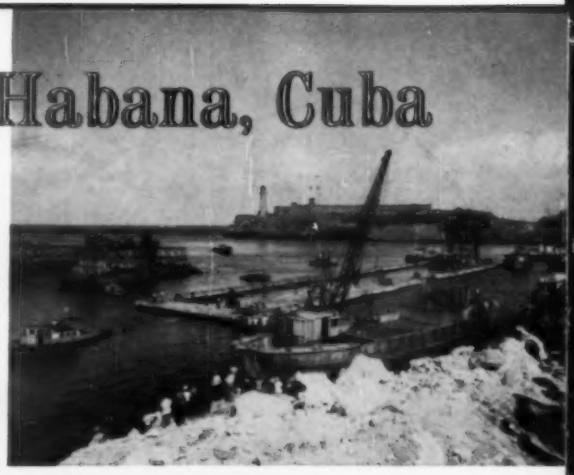
See your Mueller Representative or write direct for full details.

MUELLER CO.

DECATUR, ILL.

Tunel de la Habana, Habana, Cuba

Remarkable engineering accomplishment, protected from water with the **Thoro System Products**



Four-lane, underwater tunnel, connecting Malecon Drive, City of Havana, Cuba with Guanabacoa near the famous Morro Castle, opening the sparsely-populated peninsula to residence and commercial activity.

Mammoth precast concrete sections are floated to location by attached pontoons, lowered 24 meters under water and connected to previously-sunken sections. ***Note the famous Morro Castle. Top, center background.***

Design, engineering and construction by Societe des Grand Travaux de Marseilles, Paris, France, 733 Meters Long, 23 Meters Wide, 7 Meters High, cost $28,500,000.00. Waterproofed inside and outside with THORO System products, THOROSEAL, WATERPLUG and THORITE. Two lanes will be opened by December, 1957.

From Havana side, tunnel entrance grades down to harbor pool level.

Thoro System Products applied, completes the job!

Preparing interior surface for WATERPLUG and one brush and one trowel coat of THOROSEAL. All walls, floors and ceilings are sealed with THOROSEAL.

Two double-lane tunnel sections take shape; forms will be filled with poststressed concrete.

THOROSEAL is being applied to all interior surfaces. Over 800 drums of WATERPLUG have already been used, where water was entering and where sections were joined together. All honeycomb and construction faults were sealed with THORITE Patching Mortar, before lowered to position in the bay.

Precast sections of tunnel, honeycomb patched with THORITE Patching Mortar and entire surface protected with THOROSEAL.

Thousands of drums of THOROSEAL, WATERPLUG and THORITE Patching Mortar are being used on this vast project, which will be completed in February, 1958.

Write for literature "HOW TO DO IT"

Standard Dry Wall Products, Inc.

NEW EAGLE, PA. CENTERVILLE, IND.

In Bay Village, Ohio—Cuyahoga County Engineers combat corrosion with over 37 tons of wrought iron plate for 48-inch sewage line

Corrosive threat plus inaccessible location added up to Wrought Iron for 48″ O.D. sewage line

There was no question about the corrosion factors involved in the sewage line planned to serve Bay Village, Ohio. Compounding the problem was an almost inaccessible location that would make repair and maintenance difficult and expensive. And added to these considerations was the need for a material with sufficient structural strength to permit a 60-foot span between two trusses on either side of the valley the line had to cross. Cuyahoga County Sanitary Engineers, under the direction of Mr. John Puzenski, answered all these requirements with wrought iron. More than 37 tons of ½-inch wrought iron plate was fabricated into 48-inch diameter pipe and installed in approximately 270 feet of the sewage system.

Morgan Steel Products, Inc., Cleveland, Ohio, handled the fabrication. Installation work was done by The Utilities Construction Company, Cleveland, Ohio.

Our bulletin, *Wrought Iron for Sewage Treatment and Disposal Installations*, gives complete details on wrought iron's ability to last longer, at lower cost per year. Write for your copy.

A. M. Byers Company, Pittsburgh, Pa. Established 1864. Division Offices in Boston, New York, Philadelphia, Washington, Atlanta, Chicago, St. Louis, Houston, San Francisco. International Division: New York, N. Y.

Available in Canada and throughout the world

BYERS Wrought Iron Tubular and Hot Rolled Products

ALSO ELECTRIC FURNACE QUALITY STEEL PRODUCTS

patched with THORITE Patching Mortar and entire surface protected with THOROSEAL.

Standard Dry Wall Products, Inc.
NEW EAGLE, PA. CENTERVILLE, IND.

THE MAN WHO SAID *"No!"*

He's a business man looking for a place to build a new plant . . . a plant that will bring prosperity and growth to the community he chooses. Water supply is one of the most vital questions, and many a golden opportunity has been lost by a community because its water system is inadequate.

In Plattsburgh, N. Y., the story was different. Wasteful habits were causing water shortages, so Plattsburgh decided to install water meters. As a result, they "found" 1,400,000 more gallons daily . . . enough to supply a new Strategic Air Command Base now located there.

Even communities who have had meters for many years . . . but have allowed them to run down . . . can "find" more water simply by repairing the meters.

These savings are *real*. The meters give a strong money incentive for conservation. They help keep wells and reservoirs from running dry. The same filter plants and water mains may serve up to twice as many customers . . . with lower daily operating costs.

Your Neptune Trident meter representative will be glad to offer further evidence.

279

NEPTUNE METER COMPANY
19 West 50th Street • New York 20, N. Y.

NEPTUNE METERS, LTD.
1430 Lakeshore Road • Toronto 14, Ontario

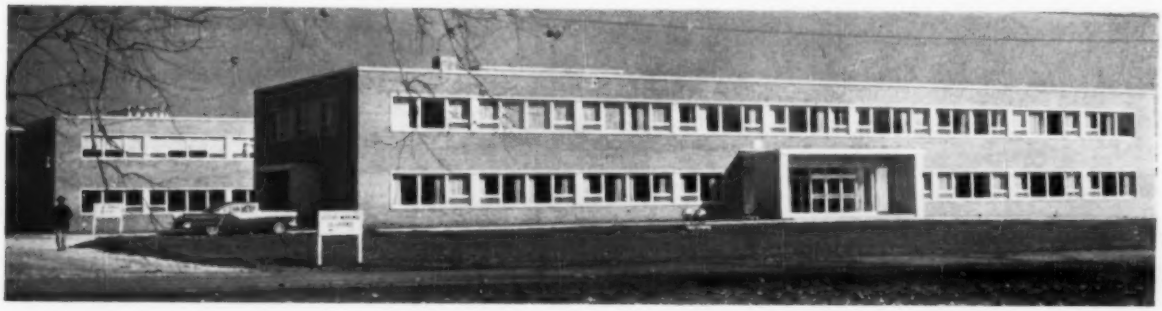
Branch Offices in Principal American and Canadian Cities.

neptune

Vol. 105, No. 1 · January, 1958

A Scranton Gillette Publication

WATER & SEWAGE WORKS



SERVICE BUILDINGS such as this one in Indianapolis are becoming more attractive and better designed for use. This is but one indication of . . .

Water Supply Progress *in 1957*

LEWIS S. FINCH, Vice President and Chief Engineer of the Indianapolis Water Co. in Indianapolis, Ind., and Vice President of the American Water Works Association, looks back at the accomplishments of the water works industry in the past year and sees that the growing realization of the importance of water supplies outweighed the development of new methods and equipment.

■ IN THIS YEAR of Sputnik I and Sputnik II, there is what might, to a casual observer, appear to be a parallel development in the water supply industry. The picture on the next page of the man and the "what is it" bears out this conclusion. The man in the picture is Gerry Arnold, General Superintendent of Water Works for the City of Philadelphia. He is well known to the water supply industry and would not himself, be considered a 1957 innovation. The strange device to which he is pointing *is* a 1957 "first", however.

It is not a model of Sputnik Muttnik or any other satellites. It is the first introverted fire hydrant. It was designed by "Gerry" Arnold and manufactured by the Darling Valve & Manufacturing Co., and the first one was installed in Philadelphia in March, 1957. It might be said to be a fire hydrant with retractable nozzles. Actually, the nozzles are not retractable, but removable. When the hydrant is to be used, the plugs are screwed out of the recesses where the nozzles normally would be found and an adapter, which is carried upon the fire truck, is screwed in and the hose attached to the adapter. This hydrant model has the advantage in that it is difficult for unauthorized persons to operate. What is more important, in the case of an installation close to a curb, the protruding nozzles which normally would be found on a standard hydrant, are not there to hook the passing automobile fender.

By the time of the American Water Works Association convention in Atlantic City in May, the A. P. Smith Co. also had developed a similar hydrant which they, as well as the Darling Co., exhibited.

The future of this hydrant remains to be seen, but certainly it represents a carefully thought out effort to get away from the conventional hydrant. It certainly is a 1957 "first".

1957 Rainfall

It seems appropriate to start this discussion with "Rainfall" since that is the original source of all water supplies. With respect to rainfall, the year 1957 has been noteworthy because of the variables which have been encountered—not only across the

"NOT SPUTNIK-III" says G. E. Arnold, General Supt. of Water in Philadelphia, but a new style fire hydrant designed by him and built by Darling Mfg. Co.

country as a whole, but even in local areas. For example, early in the year, Dallas was plagued with a drought of long-standing. The situation there was so serious that water was being peddled in containers. In May, however, the drought was broken by a deluge which caused a flood. This situation prevailed, not only in Dallas but in the entire drought area of the Southwest.

Then, in the Middle West during mid-summer there were many torrential rains which broke records right and left. These rains produced floods which seriously damaged many water works facilities. Further, in spite of these cloud bursts, the rainfall in the Middle West generally was so well distributed that little or no lawn sprinkling was carried on. While this had the effect of relieving the supply situation for many of the cities which are unable to supply sufficient water for normal lawn sprinkling needs, it also reduced the revenue normally accruing to water utilities during the summer months.

In the eastern part of the country, a severe drought was experienced while the mid-west was having too much water. In fact, in November, the mid-Atlantic states still were in the grip of a serious drought. In some industrial areas, industries were faced with the possibility that, if it did not rain, they would be forced to cease operation in order that dwindling water supplies might be devoted to strictly domestic use by the customers of the utilities. For example, arrangements were being made in some of the larger New Jersey cities so that if it did not rain soon, water could be peddled as it was in Dallas last spring. Orange, N. J., a city of some 40,000 people was out of water and depending upon East Orange for its supply.

While these specific areas are being mentioned, it should not be considered that their troubles are necessarily typical of what is happening all over the East, but rather that they are a symptom of a water supply disease or problem which may plague many communities in all parts of the country.

Public Understanding

As a result of the wide spread occurrence of such drought situations, many communities are paying more attention to the adequacy of their water supplies and the need, not only for making them presently adequate, but for making them safe for the future. In fact, throughout the country there has come a realization of the necessity for careful study and analysis of water supply problems, not only of the present but of the future.

Too often, in the past it has been the practice to worry and fret during a drought and then dismiss the need for remedial measures as soon as it

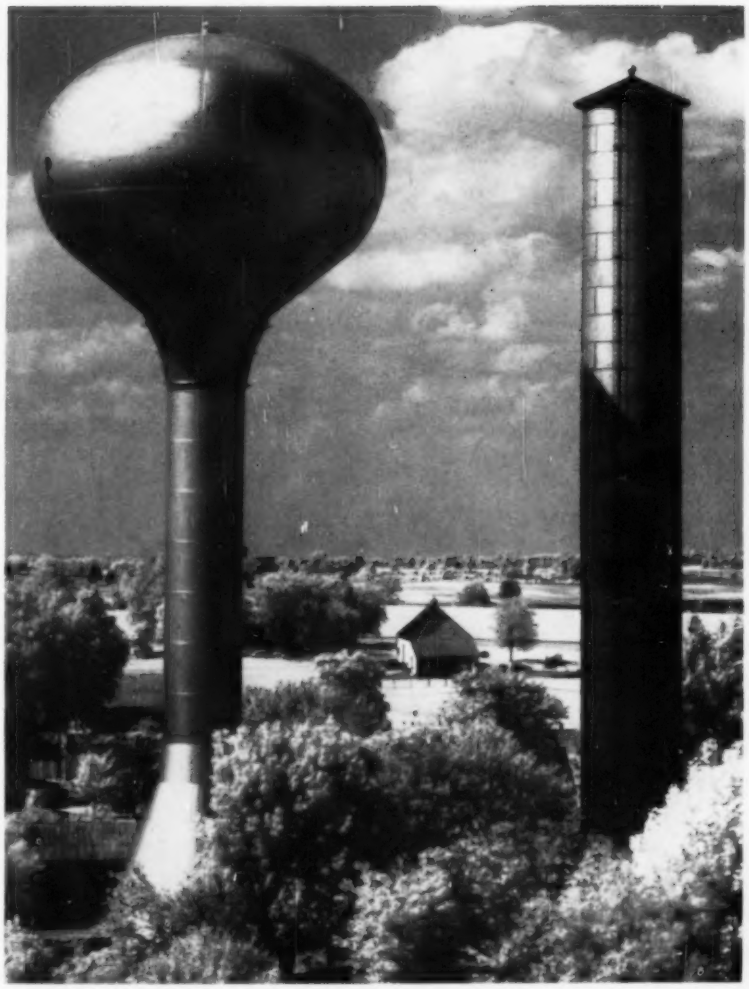
PLEASING DESIGN is evidenced by 5 mil gal ground storage tank at Atlanta, Ga. Courtesy Chicago Bridge & Iron Co.

rains. Apparently, this no longer is to be the case—at least in many of the larger cities. For example, Washington, D. C., Cleveland, Detroit, Chicago, Milwaukee, and Denver water utilities are carrying on studies looking toward the development of water supplies and facilities which will be adequate to care for the community needs 15, 20, or even 50 years hence.

Many other cities are doing the same and failure to include them in this list of cities should not be taken to mean that their efforts are being belittled. All of them cannot be named and those which have been specifically mentioned are but examples of many others which are doing likewise.

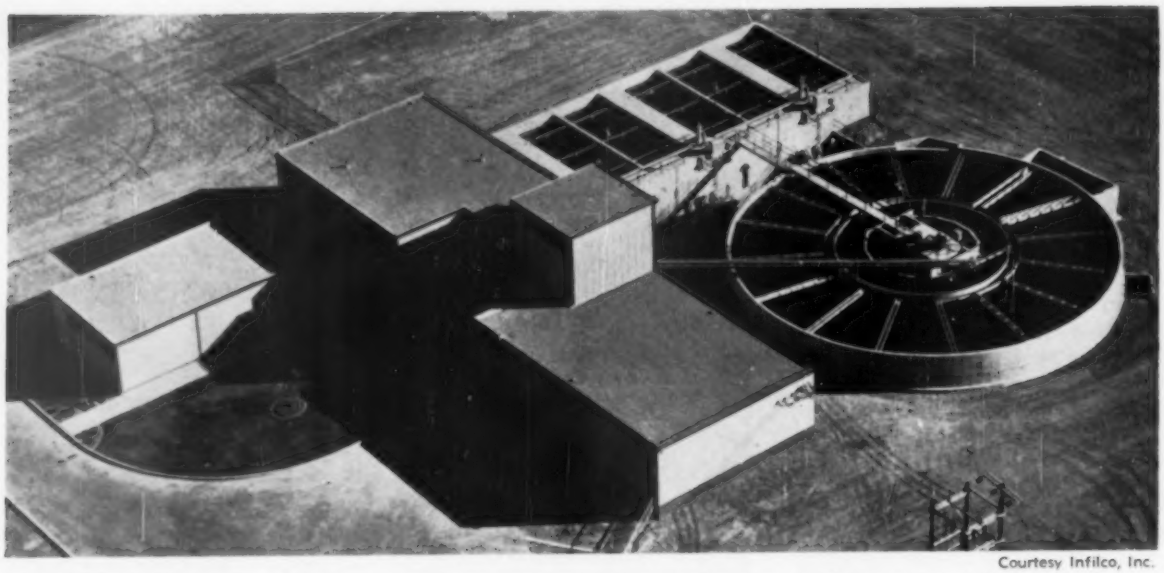
In the case of many of these cities, it is an instance of locking the door after the horse is stolen for many of them have had to curtail the use of water every summer for a number of years, not in all cases because of a shortage in supply, but often because of inadequacy of plant and distribution facilities.

As an example of work being done toward looking to the future, Cleveland has just completed the construction of a new reinforced concrete pipe intake on which work has been underway for several years. This intake brings water from a crib located two and one-half miles out in Lake Erie. The intake was built of 96-inch inside diameter concrete pressure pipe, manufactured by Price Bros. of Dayton. Incidentally, this pipe, which comes in 24 foot lengths, weighs 72,000 lb



THE NEW AND THE OLD—A 500,000 gal Hortonsphere at Mt. Vernon, Ind. replaces a standpipe (since dismantled.).

FILTER DECK at Toledo, Ohio new purification plant provides attractive appearance with glass windows through which to observe filter operations.



Courtesy Infilco, Inc.

EL CENTRO, CALIF. boasts of this new 15 mgd water treatment plant designed to supply the desert city's 600 gpcd demand at low cost.

per section, and the weight alone created such a problem, that the pipe had to be handled by unusually large derrick barges. It was jointed under water by divers. A special precast reinforced concrete elbow, which formed the center of the 60-foot diameter crib, weighed 93 tons.

As further evidence of the fact that Cleveland is looking toward the future, the treatment plant which this intake will serve, for the present has a capacity of 50 mgd. The next stage of construction of this plant, as planned, would be to increase this capacity to 140 mgd. The ultimate capacity of the intake which is built for the future is approximately 250 mgd.

This discussion, as previously stated, is not to "toot" Cleveland's horn, but to cite an example of how cities are beginning to look to the future.

AWWA Action

The American Water Works Association is cognizant of the need not only for increasing supplies and plant facilities to meet present requirements, but for looking well into the future and developing plans and projects of such scope that future generations may be spared the shortages plaguing the industry in 1957. The Association is developing a water supply information program designed to make people conscious of the necessity for providing adequate facilities and for paying the rates necessary to insure that money will be available to pay for adequate facilities.

To accomplish this program, ,the Board of Directors of the Association this year has authorized the expenditure of a substantial sum of money and the development of a study committee to determine the best method by which the Water Works Association can assist in furthering developmental programs. Such a committee has been organized and will submit a report to the directors in January with a specific recommended program. Mr. John Murdoch, Jr., now retired, but formerly associated as general counsel with the American Water Works Service Co., has been retained as a special consultant to assist this committee in developing a program.

This program not only will be patterned to apprise the public of the need for giving more consideration to water supply requirements, but also to assist the water works officials themselves in developing their own programs which will lead to a better appreciation upon the part of their customers and the public of the necessity

Courtesy Dorr-Oliver, Inc.

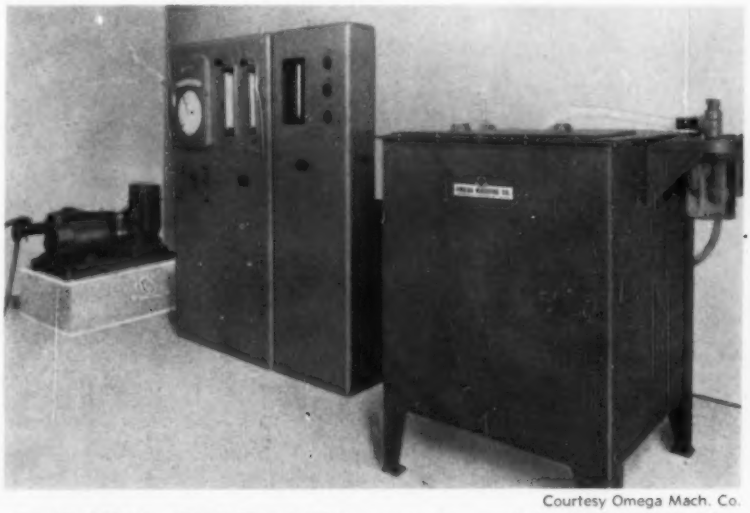
DESANDING SYSTEM installed at Hobb, N. Mex. has removed as much as 47,150 lbs of sand in seven days, but what fills the voids left by the sand is not known.

TORNADO destruction at Ruskin Heights—Hickman Mills, near Kansas City is evident, but 400,000 gal elevated storage tank withstood the estimated 500 mph fury of a direct hit by the twister.

for providing adequate facilities, both for the present and the future. And, further, of the necessity for paying such rates as may be necessary to make it possible to provide such facilities.

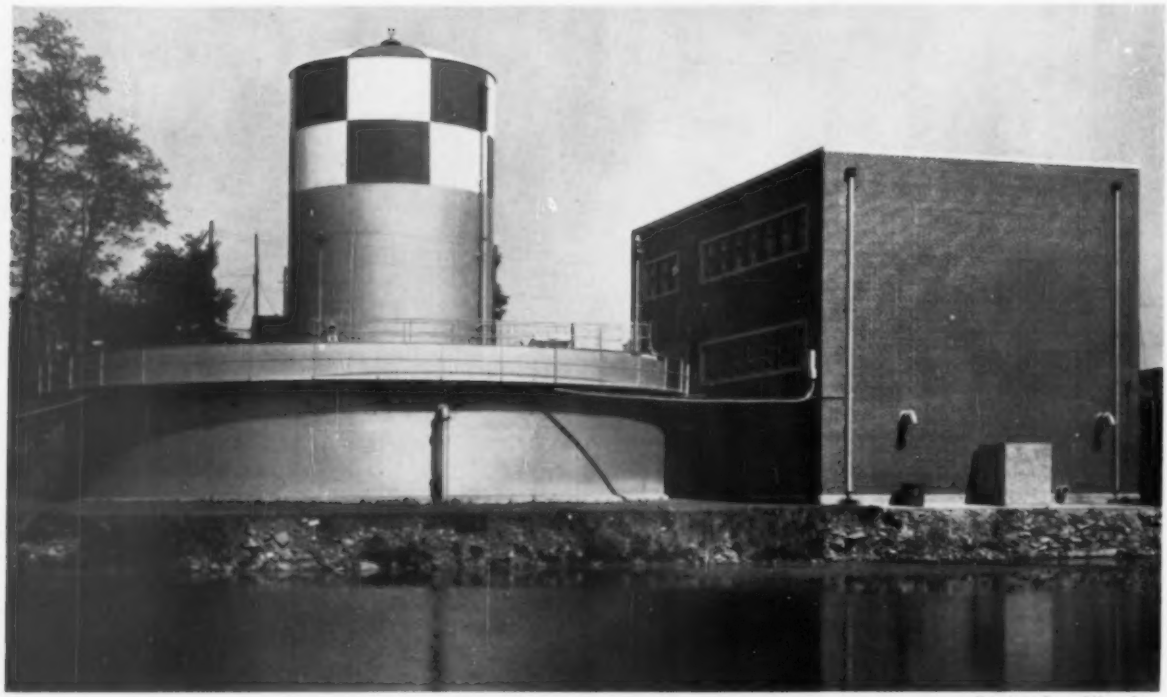
The New Jersey Section of AWWA has taken the lead among the local sections with respect to readying itself for assisting in such a developing program, by the appointment, at its annual meeting in October, of a "toot and holler" committee. This might be said to be a speakers' bureau of water works men who will be available to assist local communities where there is a current water supply problem, or where a study of future demands should be made, by disseminating water supply information designed to stimulate local action. It is anticipated that other Sections of the Association also will form such committees.

It must not be supposed that only water works people are aware of water resources problems for such is not the case. For example, the League of Women's Voters in May 1957 published a very worthwhile brochure entitled "On the Waterfront". They characterized it as "an introduction to the Administrative, Legislative, and



Courtesy Omega Mach. Co.

CONTINUOUS ACTIVATED SILICA preparation and feeding unit at Big Cottonwood Water Treatment Plant in Salt Lake City, Utah, will produce up to 100 lb per hr of activated silica for coagulant aid. The device features chlorine activation and a remote sodium silicate pump control from a panel.



Courtesy Dorr-Oliver Inc.

NEW CUMBERLAND, PA. experienced an increased demand since this 2 mgd plant was built in 1954 for the Riverton Consolidated Water Co. and during the past year a duplicate was started. The plant features a "Dorrco PeriFilter System" and "Dorrco Hydro-Treator".

Economic Problems Involved in Water Resources Development."

Water supply problems also are being recognized as items of general interest by magazines of national circulation as well as by the daily press. For example, *Newsweek* of November 11th and the November issue of *Coronet* carried water resources articles. During the year, there have been articles in several other magazines of general interest.

This awakening appreciation of the fact that there are water supply problems which must be solved is an indication that the water supply official soon may have less local inertia to overcome when he undertakes an expansion program.

Courtesy Fairbanks-Morse

MIDWEST CITY, OKLA. solved its water supply shortage problem with new wells, new ground storage, new mains and a new pumping station with eight motor-driven F-M Pomona booster pumps with a combined capacity of 7,500 gpm.

Distribution Storage

During 1957, the accent continued to be placed upon the installation of larger and larger ground reservoirs on the distribution systems. It is well known that these ground tanks are of great value upon a distribution system. Their utilization makes it possible for primary pumping stations to operate at a more nearly uniform rate "around the clock". Water is drawn from them in the daytime and they refill at night, thus making it possible to pump at a lower head in the daytime and to operate more efficiently at night. They also accomplish the same purpose as would reinforcement of the distribution system and at much less cost.

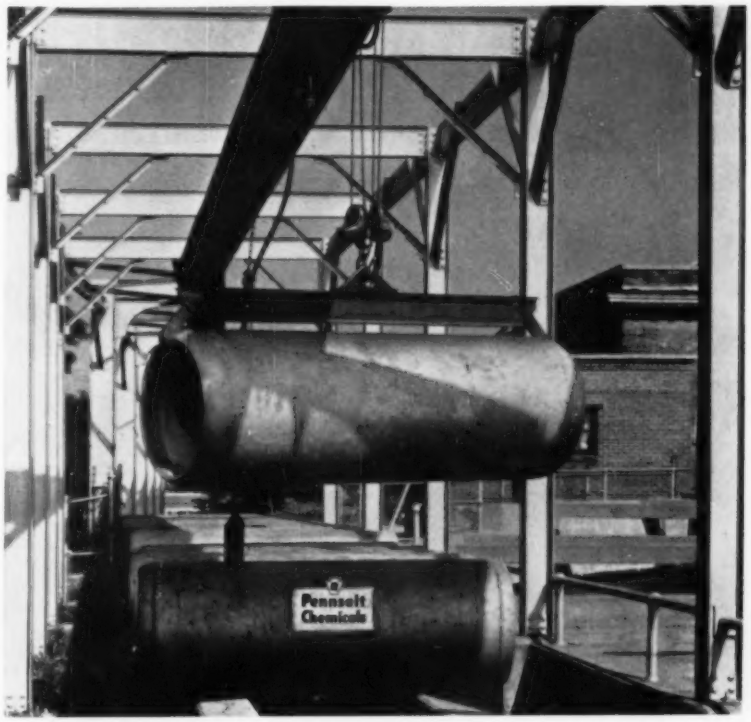
Courtesy Worthington Corp.

PUMP FLOOR at main pumping station of Cincinnati Water Works contains four Worthington horizontal centrifugal pumps driven by General Electric motors. Operating panels are on upper deck.

That they can be built of pleasing design is evidenced by the five million gallons, ground storage tank which has been installed by Chicago Bridge and Iron Co. at Atlanta, Ga. This may be seen in an accompanying photograph. This particular tank is shown not to illustrate construction work done in 1957 necessarily, but rather to show the trend toward ornamentation.

In 1957, larger and larger Horton water spheroids are being installed. The largest to date has a capacity of 750,000 gallons. The accompanying photograph of a spheroid tank at Mt. Vernon, Ind., illustrates the appearance of the tanks of this type which are being installed. It has a capacity of 500,000 gallons. This picture was included here primarily to show old and new tanks side by side.

A situation developed on May 20th, 1957, which answered the question in many persons' minds of what would happen to an elevated tank if it were to be struck by a tornado. The accompanying photograph of a 400,000 gallon capacity tank, standing 148 feet



CHLORINE HANDLING at Queen Lane Pumping Station in Philadelphia provides for use of ton containers.

ASPHALTIC CONCRETE is placed on downstream surface of rock filled dam for the Colorado Springs Water Supply Works. This dam which is 10,861 ft above sea level, is 1850 ft long, 113 ft high above stream channel and has a crest 20 ft wide. Asphaltic concrete 12 in thick, was also used on the upstream face of the dam.

above its foundation,[1] shows the tank standing alone amidst the ruins of a residential development in the Ruskin Heights—Hickman Mills area adjacent to Kansas City, Mo.

As can be seen in the picture, the area about the tank was completely devastated. Eye witnesses stated that the tornado funnel actually was split by the tower—indicating that the tank was directly in the path of the tornado. An AWWA staff report presented in the October 1957 Journal of AWWA contains the information that the tank was designed to withstand a 100 mile per hour wind in accordance with AWWA standards. Nevertheless, it has been estimated that the tornado had a velocity of 500 miles per hour and the tank still stands!

[1] Erected by Chicago Bridge & Iron Co.

Chlorination

The year 1957 marked the introduction of the "Quantity—Quality" Chlorinator.[2] With it, the operator selects the chlorine residual required after a predetermined contact time, and the chlorinator automatically maintains that residual. It automatically adjusts the rate of feed to compensate for changes in chlorine demand so that the required residual will be maintained. As installed, the equipment samples the water to be chlorinated ahead of the point of application and determines the chlorine demand ahead of the main chlorination treatment. Thus, varying plant and raw water conditions can be met as they occur. This equipment was first exhibited at the 1957 AWWA convention in Atlantic City.

[2] Manufactured by Wallace & Tiernan, Inc.

Courtesy U. S. Pipe & Fdry. Co.

MAIN EXTENSIONS for 20 mile rural lines at Gainesville, Fla. consisted of "Tyton" joint cast iron pipe.

Courtesy Cast Iron Pipe Res. Assn.

FIRST PIPE BRIDGE of its kind in Chicago was constructed of steel to carry 42-in. standard mechanical joint cast iron pipe (manufactured by Amer. Cast Iron Pipe Co.) over a river where existing wooden highway bridge was not strong enough to carry an additional load.

Desanding System

While fortunately it is not a problem for most water works systems, there is a significant number of them, however, which do have sand problems. At Hobbs, New Mex., is an example of a well supply which continuously yields sand. A "Dorrclone" Desanding System[3] unit installed at Hobbs with the result that 47,150 lb of sand were recovered over a seven-day period. The writer is not in a

[3] Developed by Dorr-Oliver, Inc.

position to state what will fill the voids left by so many pounds of sand when the well is operated from day to day, but be that as it may, equipment now is available, which will remove sand without the construction of an open basin and attendant repumping of the water.

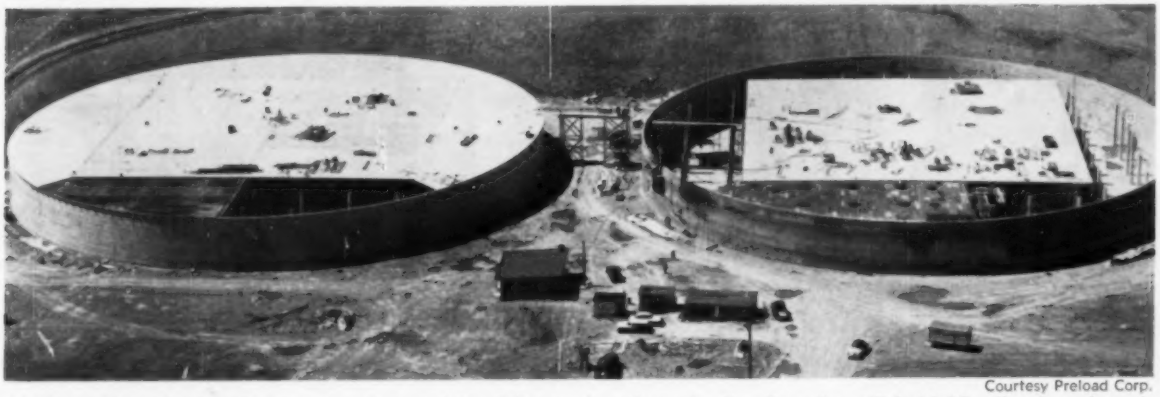
Pipe Joints

During 1957, there have been no significant innovations with respect to joints in pipe for distribution systems. There has, during 1957 however, been a very wide acceptance of the new single ring type joint developed by the cast iron pipe industry during the last few years. This joint, with minor differences in dimensions, has been manufactured under the trade names of "Tyton", "Fastite", "Bell-tite", and "Altite".

An interesting river crossing was developed by the City of Chicago using standard mechanical joint pipe, 42 inches in diameter, manufactured by the American Cast Iron Pipe Co. This pipe was placed upon a steel bridge built especially for this purpose as the adjacent wooden bridge was not strong enough to carry the load.

Courtesy of Henry Pratt Co.

48-INCH AWWA STANDARD high pressure butterfly valve and operator are buried directly in the ground at Toledo, Ohio. The valve operator is of submersible design to withstand seepage.



Courtesy Preload Corp.

PRESTRESSED CONCRETE reservoirs designed by Gilbert Associates for Reading, Pa. will hold 13 mil gal each and improve the stored supply capacity of the city.

Research

Harry Faber, Research Coordinator, Office Engineering Resources, U. S. Department of Health, Education & Welfare, reported to the 1957 annual meeting of the Chesapeake Section of AWWA in Washington, D. C., in October, concerning the work being carried on under his direction. Mr. Faber explained that the Public Health Service in 1957 made 81 wa-

Courtesy F. B. Leopold Co.

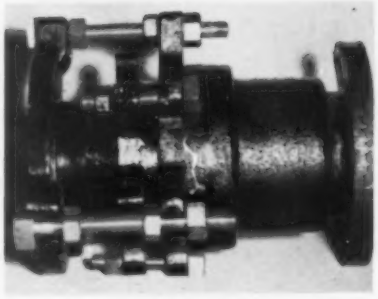
42-INCH butterfly valve was installed on supply line for City of Lancaster, Pa.

RUBBER WATER STOPS manufactured by Servicised Prod. Corp. were used to seal all construction and articulated joints on prestressed concrete storage tanks at Reading, Pa.

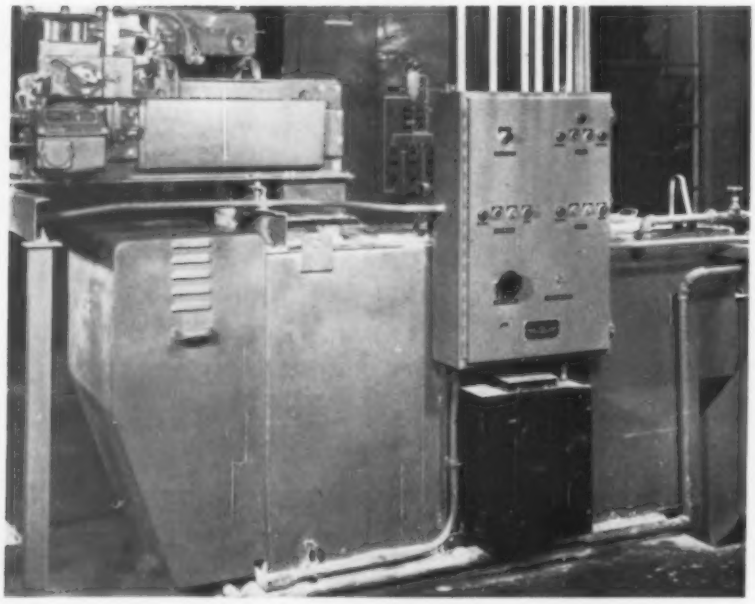
AUTOMATIC ADJUSTMENT of a chlorine feed to compensate for changes in chlorine demand is possible by this Quantity-Quality Chlorinator, first shown at the AWWA meeting in Atlantic City in May 1957.

Courtesy Wallace & Tiernan, Inc.

LINE OPERATED, direct reading meter, features push button control was introduced by Beckman Scientific Instruments Div.



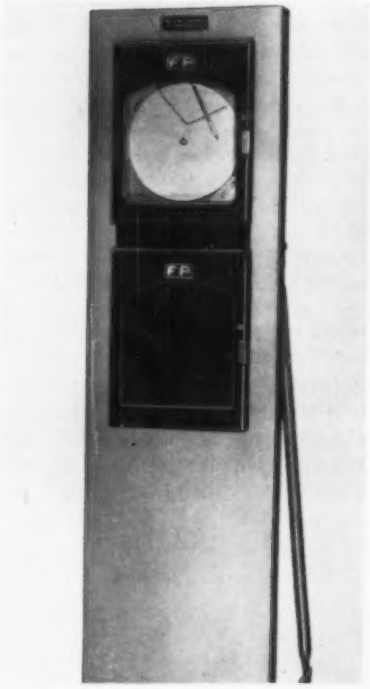
SLIP-JOINT designed and manufactured by Multiplex Mfg. Co.



COLD WATER LIME SLAKER at St. Paul, Minn. (one of two) handles 4000 lb per hr. These are Infilco, Inc. "Viscomatic" paste slakers featuring control panel and grit removal.

▲ NEW STYLE operating console for new filters in Philadelphia, designed and manufactured by Builders-Providence, Inc., Div. of B-I-F Industries, Inc.

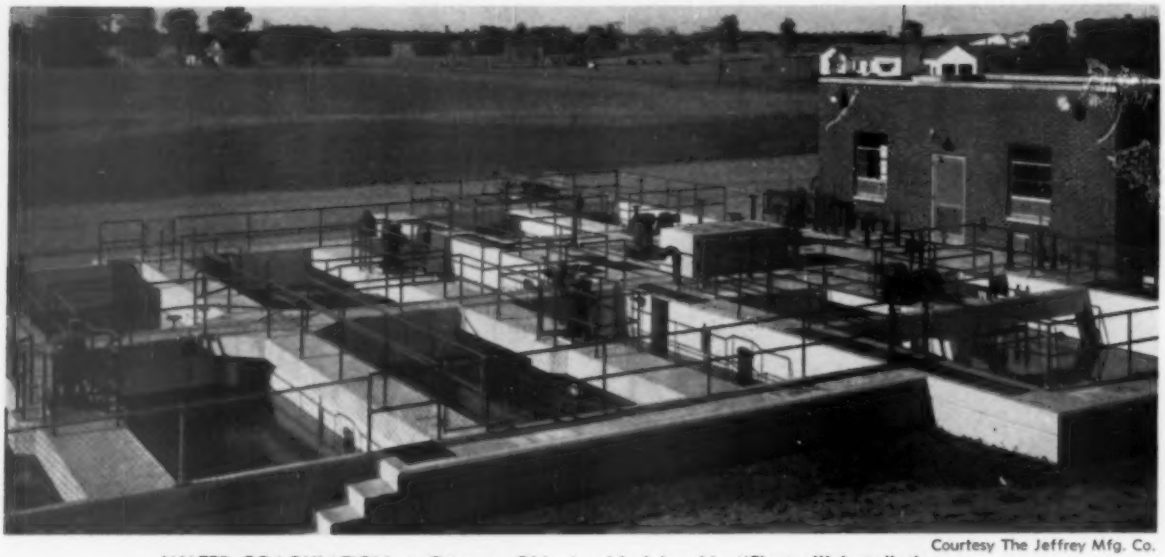
▲ DATA LOGGER installed at water plant in Massapequa, L. I. by Taller & Cooper Inc.



▲ RESIDUAL CHLORINE Analyzer developed by Fischer & Porter Co.

INDICATOR-TOTALIZER for flow rate and totalization resulted from eight years of research and development by Sparling Meter Co. ►

▲ PIPE LEAKS under pavement may be detected with this microphone-amplifier system which filters out low level noises from traffic. Manufactured by Computer-Measurements Corp., Hollywood, Calif.



Courtesy The Jeffrey Mfg. Co.

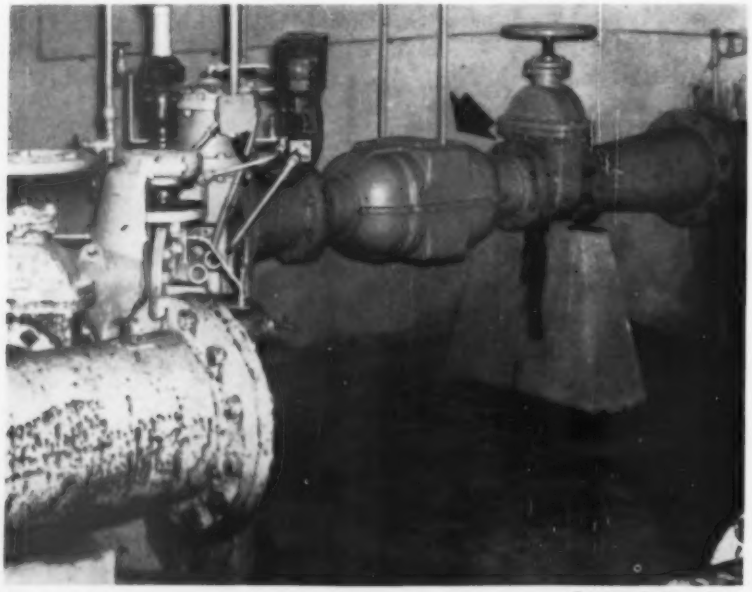
WATER COAGULATION at Ottawa, Ohio is aided by this "Floctrol" installation.

ter supply and water pollution control research grants—totaling $756,793.00. In the 11 years since this program has been in operation, a total of $2,829,000 have been allocated to such research grants. The 1957 allowance was over 100 percent greater than that of 1956. The following table taken from Mr. Faber's report contains a classification of the 1957 research grants.

In his report, Mr. Faber pointed out that one of the difficulties in working out the research program, which the Public Health Service is developing, stems from the fact that little is known about the research work being carried on by independent agencies. To correct this situation, Mr. Faber started, in 1957, to make a survey of all possible agencies which might be expected to be carrying on research work along water supply lines. When he has completed his survey, the information will be available not only to the Public Health Service, but to the water works industry as a whole. This should prevent a duplication of effort upon the part of various members of the water supply industry. Mr. Faber indicates that he will carry on such a survey every year so that similar information will be available each year hereafter.

Classification of Research Grants by U. S. PHS

Types of Research		No. of Grants
Analytical Methods		12
Toxicity Studies		7
Treatment Methods		32
General	14	
Sedimentation	2	
Biological	13	
Sludge	3	
Water Pollution		30
Total No. of Grants		81



Courtesy Foxboro Corp.

MAGNETIC FLOW METER was installed in 1957 at Bloomfield Township Water Dept., Bloomfield Hills, Mich. to record rate of flow at pumping station

Dam Construction

No attempt has been made to search the literature or to canvas the consulting engineers to determine outstanding examples of dam construction in 1957. An interesting innovation, however, has come to the attention of the author. This is a unique method of paving the downstream face of a rock-filled dam located on the middle fork of the South Platte river about five miles upstream from Alma, Colo. This dam was completed in October after four seasons of construction. It is a unit of the water supply works constructed by Colorado Springs. The dam has the distinction of being located at an elevation higher than any other large dam in the United States—the elevation of the spillway being at 10,861 feet

above sea level. The dam is 1,850 feet long of rock fill construction. It is 113 feet high above the stream channel. The crest is 20 feet wide and the slopes of the upstream and down faces are 1.7 to 1 and 1.5 to 1, respectively. The structure contains 654,000 cubic yards of rock.

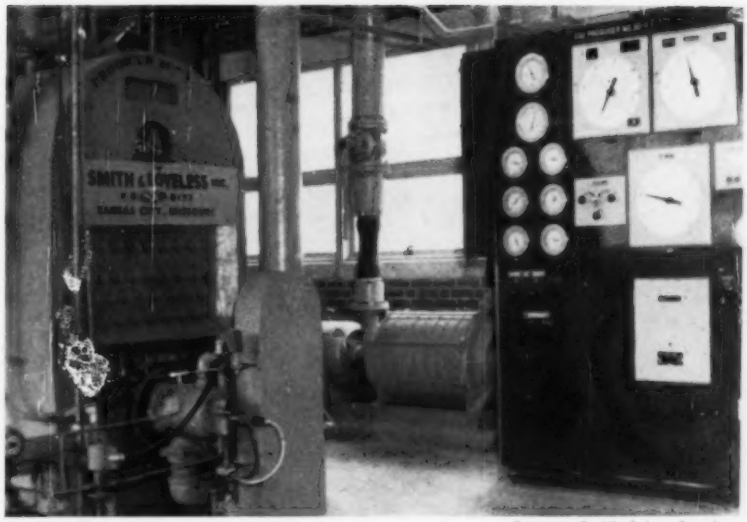
The innovation at this dam is in the use of asphaltic concrete as a waterproof deck on the upstream face of the dam. In the past, concrete has never been too satisfactory for this purpose because of the cracks resulting from movement under load and settlement of the fill. Asphaltic concrete is a relatively low cost material that will provide a flexible waterproof deck and it was selected for installation after two years of exhaustive laboratory testing and study. The deck is 12 inches thick and weighs 146 lb per cubic foot. The amount of asphalt required for the face was 20,000 tons. The dam was designed and the work carried out under the direction of Black & Veatch, consulting engineers of Kansas City. The accompanying photograph is of interest in that it shows the method which was used in placing the downstreams asphaltic surface.

Purification Plant Innovation

In 1956, the St. Louis County Water Co. placed in operation a purification plant of novel design. The design, in fact, is so novel that it has been felt that a report regarding the first year's operation should be included in this 1957 progress report. The plant, which is known as the South County Plant, has a capacity of 15 mgd and for several years its use will be required only during the summer peak load period. In designing the plant, consideration was given to the fact that its capacity is supplemental to the supply available from other plants. Particularly, the design provides for filter washing, basin cleaning, and preventive maintenance work being carried on while the plant is out of service during the night hours and winter periods. Because of the short operating season and the necessity for spending as little money as possible, the most unusual plant design was adopted. Cost of the intake plant and pumping station was less than $75,000 per million gallons including auxiliaries.

It is of interest that submersible pumps have been used in the intake. They are protected by trash bars and a small screen of minimum area. The use of submersible pumps on such service has been found to be satisfactory after the first year of operation.

There was no attempt made to construct a minimum cost plant where such construction would be inconsistent with the high standards of utility service and water quality insisted upon by the St. Louis County Water Co. The plant accomplishes suspended solids removal, contact softening, settling, flocculation, secondary settling and submerged filtration all in one basin created by earthen dikes. (See p. 91 of March 1957 issue of



Courtesy Smith & Loveless Inc.

CARBON DIOXIDE is produced by one handle control "Recarber" completely instrumented at Kansas City, Mo.

Courtesy Wheeler-Economy Pumps

VERTICAL MOUNTING of horizontally split case pump solved space problem at Los Angeles new San Pedro Pumping Plant

Wat. & Sew. Wks. for diagram and illustration of this design.)

The first zone in the purification basin is a 60 minute, 100 ft diameter suspended solids contact softener. A light cylindrical steel shell, which is not designed for unbalanced waterheads, separates the softening zone from the rest of the basin. This softener is operated unconventionally in that slurry or sludge is not withdrawn to maintain a specific slurry pool or sludge blanket level. Sludge is allowed to build up in the unit and boil over the top into the next zone of the purification basin. The only sludge which is withdrawn is that portion which settles on the bottom of the basin and then cannot be resuspended by the circulating propeller.

Of this operation, Mr. H. Hartung, Supt. of Production for the St. Louis County Water Company writes as follows:

"The importance of lime softening in the presence of considerable quantities of previously precipitated softening sludge has been demonstrated during the past operating season. Suspended solids in the center draft tube over a period of more than several days has been as high as 8 per cent by weight. When softening is in the presence of 2 per cent by weight, or more, of suspended solids there has been an appreciable improvement in hardness reduction and corresponding alkalinity reduction.

"As an example, during the first two weeks of October with a suspended slurry concentration of 2½ per cent or higher by weight, the calcium reduction in the softener was from 40 ppm to 3 ppm. When the slurry was reduced to less than ½ per cent by weight, the calcium reduction was from 40 ppm to 10 ppm. There have been numerous other occasions when the contact softening basin was operated with and without appreciable suspended solids and the same kind of difference in hardness reductions were obtained."

The operation of the submerged filter likewise has proven to be satisfactory according to Mr. Hartung. The most unusual part of the purification plant is the two filter unit located in the end of the purification basin. The filter boxes are within the basin and are completely submerged. The filter sand is accessible only by lowering the water level in the entire purification basin. Of the operation of the submerged filter, Mr. Hartung writes as follows:

"The description of the washing of the submerged filter (see *Water and Sewage Works,* Mar. 1957) stated that a basin sewer valve is normally opened to waste water from the basin at the same rate that filter wash water is entering the basin. Experience this past year has shown that the wasting of filter wash water is not necessary. Since May of this year, all of filter wash water has been retained in the purification basin and thus is reclaimed. The amount of wash water used has been reduced to 2 per cent of the total amount filtered. However, the per cent wash water used is a relatively unimportant figure inasmuch as only the energy in this water is used since the water is reclaimed.

"Filter sand sieve analyses have shown that there is no change in sand sizing since the sand was placed in the filters. These sieve analyses are an indication that the softened water which is filtered is relatively stable, and that the submerged filter washing is adequate."

"Filtration rates are determined by high service pump operation. The filters are not equipped with rate-of-flow controllers. This scheme of operation has not resulted in any water quality deterioration."

Certainly this plant and its operation bears watching. A complete description of the plant by Mr. Hartung appeared in the March 1957 issue of *Water & Sewage Works.*

Another plant employing unique features went into operation at Oneonta, N. Y. during 1957. Of particular interest at this plant is the use of calcite flour fed with alum for coagulation. This treatment is described by Thos. M. Riddick, the designer, in another article in this issue of *Water & Sewage Works.*

Service Buildings and Operational Centers

Several Service Buildings and Operational Centers were placed in service during 1957 by the Water Utilities across the country. The author is most familiar with the one built by Indianapolis Water Co. and occupied during October. It was fully described in an article in the May 1957 issue of *Water & Sewage Works.* All service buildings and operational centers are being built with a careful view toward efficiency of operation. Cincinnati water works has one under construction which will be ready for occupancy in 1958.

Fluoridation

A report on 1957 would not be complete without mention of fluoridation. Progress is being made and more and more communities are accepting fluoridation although its use has been rejected by several of the larger city water works.

Reports of dental caries reduction continue to be presented by dental authorities with supporting data. At the beginning of 1957 it was estimated that over 31,400,000 people in the U. S. were using fluoridated water. No information is available to the writer as to the number of people using such water at the end of the year —but no doubt, the number is significantly greater.

Acknowledgment

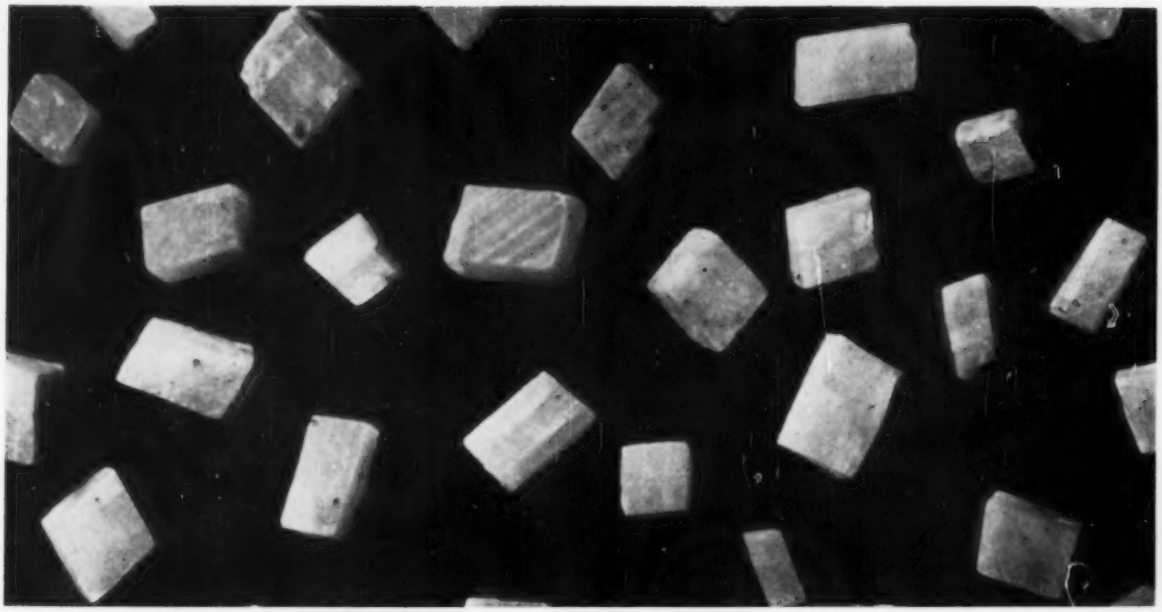
The author wishes to express his appreciation for the material assistance afforded him in the development of this progress report by the several members of the water works profession to whom he turned for information.

Chenoweth Appointed Dir. of Public Relations A.S.C.E.

The American Society of Civil Engineers, New York, N. Y., has announced the appointment of M. O. Chenoweth as Director of Public Relations.

For the past 14 years, Mr. Chenoweth has been associated with Selvage & Lee, Industrial public relations counsel, in New York. Before entering the field of public relations, he was associated with King Features Syndicate, Central Press Association and International News Service. He also served as editor of Pan American Magazine.

A native of Ohio, Mr. Chenoweth graduated from Harding High School, Marion, Ohio and Ohio State University, Columbus, Ohio, where he obtained a Bachelor of Science degree in Journalism. He is a member of Sigma Delta Chi, professional journalism fraternity; Sphinx, senior honorary society and Phi Gamma Delta.



RHOMBIC CRYSTALLINE STRUCTURE of limestone from Newton, N. J., is shown by these quarter-inch mesh size particles which occur during crushing operation to produce "flour" used in the employment of . . .

Calcite in Water Treatment

by THOMAS M. RIDDICK, NORMAN LINDSAY, and ANTONIO TOMASI, respectively, Consulting Engineer and Chemist, and Associate Engineers in Mr. Riddick's firm, New York City.

EDITOR'S NOTE: During 1957, one of the outstanding small water works dedicated and placed in operation, was that at Oneonta, N. Y. Designed by the senior author and his staff, this 4.5 mgd plant featured six innovations including the use of Calcite with alum for coagulation; recirculation of 20 per cent of the effluent from the flocculators to flocculator influent; rapid sand filters fed over weirs; butterfly valves operated by floats in the filters for rate-of-flow control; a special basin interconnected with filter effluent channels and finished water basin to keep the entire plant in continuous hydraulic balance; and advanced control circuitry to permit one man operation from a central control panel.

The first of these innovations (the use of Calcite with alum) seems to offer considerable promise to the water works industry and we requested Mr. Riddick and his associates to discuss both the background for its use as well as the actual application procedure. At a later date Mr. Riddick will write on other features of the plant.

■ IN WATER TREATMENT, it is necessary to apply some type of alkaline reagent to practically all supplies, whether from surface or underground sources. The reasons for this necessity fall into two general categories, namely —(1) Instances where it is desired to raise the alkalinity of raw waters (where deficient) to a point sufficiently high to enable effective coagulation; and (2) those where it is necessary to raise alkalinity and pH of finished waters (well or surface) for the purpose of inhibiting corrosion. Before discussing the application of calcite to these problems, a basic review of nature's methods of dissolving alkaline earths is indicated.

Nature's Part in Producing Alkalinity in Water

When precipitation falls on land surfaces, a major portion normally sinks into the ground and travels downward to the water table, which extends to bedrock or to an impervious formation such as clay. The remainder runs off quickly to brooks, streams and rivers, and unless retained by dams or lakes, eventually flows to the sea.

Moisture vapor in the atmosphere collects on dust particles, or air borne mineral salts which form nucleii for raindrops. This moisture is completely saturated with the gases of the atmosphere, which are principally nitrogen (78 per cent), oxygen (21 per cent) and argon, helium, carbon dioxide and others (1 per cent). Thus at an atmospheric temperature of 50°F (extending several hundred feet above grade), the composition of rain water, in terms of dissolved gases (if at equilibrium and at a barometric pressure of 760 mm mercury), is as follows:

	mg/L by weight	*% by volume*
Oxygen	11.2	0.80
Nitrogen	18.0	1.57
Carbon Dioxide	0.6	0.03

The concentration of these gases in water is a function of barometric pressure and the percentage of these gases in the medium through which the water falls, flows or trickles. Whereas the percentage of carbon dioxide in the atmosphere is only 0.03 by volume, the carbon dioxide content of interstitial air in the upper say three foot layer of soil generally amounts to at least one hundred times this value.* This carbon dioxide is an end product of metabolism of micro organisms — including bacteria, yeast, fungi, moulds and actinomycetes. Whereas rain water, per se, has little mineral content as it falls upon land or water surfaces; and whereas its carbon dioxide content is only 0.6 mg/L (by weight), the high concentration of carbon dioxide in the upper soil layers generally results in a pick-up of some 20 to 100 mg/L in transit from the ground surface to the water table. Carbon dioxide combines with water as follows:

(1) $H_2O + CO_2 \rightarrow H_2CO_3$

Mineral compounds and alkaline earths, which constitute the soil, dissolve very slowly in pure distilled water. The rate of solution however is greatly increased by the presence of carbonic acid (H_2CO_3); and within limits, the higher the concentration of carbon dioxide, and the longer the period of contact between carbonic acid and the mineral contents of the earth the greater will be the dissolved mineral solids in the underground water.

Practically all natural waters, including New York, New Jersey and Connecticut contain calcium and to a lesser extent magnesium bicarbonate due to this action, and all waters contain some excess of carbon dioxide, whether they are derived from running streams or from underground sources. The flow of brooks, streams and rivers is of course maintained during dry seasons of the year by the discharge of underground waters (which are relatively high in carbon dioxide) into stream beds. When this underground seepage becomes open stream flow, carbon dioxide is gradually released to the atmosphere. These conditions and reactions, though elementary, are fundamental to the concept of water treatment.

Since sub-surface waters (such as those drawn from wells or infiltration galleries) have relatively long contact with underground minerals they generally contain a greater quantity of mineral salts than brook waters from the same area. Stream waters vary greatly in concentrations of mineral solids throughout the year, whereas well waters are relatively constant; and if stream waters are collected in a reservoir, the concentration of mineral solids from the reservoir overflow (or point of withdrawal) is naturally more constant than that obtained from the streams feeding such reservoirs.

The Hackensack River at Nyack, N. Y. will vary in alkalinity from about 30 to 80 mg/L, and this moderately high alkalinity is due to the incidence of relatively large quantities of alkaline earths (principally limestone and sandstone) on the watershed. At Ossining, N. Y. the alkalinity of the raw reservoir water will vary from 14 to 18 mg/L during any year. The lower concentration at Ossining is due to relatively less calcareous rock (or soil) on the watershed. No generalization can be made with regard to watersheds, however, even those in close proximity. At Bethel, Conn., for instance, the alkalinity of Chestnut Ridge Reservoir Water varies only from 7 to 10 mg/L, whereas that of Eureka Reservoir, situated only a few miles away, varies from 20 to 30 mg/L.

Alum Coagulation Reactions

At most water works treating surface waters, aluminum sulfate is applied to form a gelatinous precipitate —which adsorbs color, iron and manganese and absorbs or immeshes turbidity. The reaction is highly complex, but for purposes of general discussion may be set forth as follows:

(2) $\underset{600}{Al_2(SO_4)_3} + 3\underset{300}{Ca(HCO_3)_2} \rightarrow 3\underset{156}{CaSO_4} + 2\underset{264}{Al(OH)_3} + 6CO_2$

The pure crystalline form of aluminum sulfate has eighteen molecules of water of crystallization, and a molecular weight of 666. The commercial form of alum employed for water works contains approximately 14.2 molecules of water and has a molecular weight approximating 600. Since alkalinity is always measured in terms of equivalent $CaCO_3$ we find the following relationships in Equation 2: 1 mg/L of aluminum sulfate requires 0.5 ppm of calcium bicarbonate (as equivalent calcium carbonate); and upon reacting, produces 0.68 mg/L of calcium sulfate (which remains in solution); 0.26 mg/L of aluminum hydrate (a gelatinous floc which mainly settles out in the sedimentation basin); and 0.44 mg/L of carbon dioxide.

From these considerations it is stoichiometrically necessary to have at least one-half as many mg/L of calcium bicarbonate as the application of alum (in mg/L). Since alum dosages are normally 15 to 40 mg/L, 30 mg/L of alum requires 15 mg/L of natural (bicarbonate) alkalinity. The law of "mass action" states that the rate of reaction is proportional to the molecular concentration of each of the reacting substances. The above reaction therefore does not go to completion (within the time normally available) unless there is an excess of about 5 mg/L of bicarbonate alkalinity. Thus an alum dosage of 30 mg/L requires at least 20 mg/L of alkaline bicarbonate.

Thus when raw water alkalinities are less than about 20 mg/L, it is generally necessary to add some type of alkali to augment this deficiency. Of the commercial alkalies available, soda ash and lime are the most commonly employed. Of these, the cost of soda ash (based on current prices and alkalinity equivalents) is about three times the cost of lime. Both lime (a hydrate) and soda ash (a carbonate) have distinct limitations—regardless of cost and of rate of application, since we need raw water alkalinity in the *bicarbonate* rather than

*"Soil Microbiology—Waxman—John Wiley & Sons, Inc.—1952.

DESIGNED for 4.5 mgd rate, this recently completed plant at Oneonta, N. Y. is now producing at a rate of 7 mgd, with no impairment in water quality.

the carbonate or hydrate form. When lime is applied to raw water before coagulation, it has the tendency to raise pH to a point so high that the normal alum dosage will not lower the pH of the treated water to a point where adequate or effective floc is formed. It also inhibits the adsorptive properties of floc so that color is often inadequately removed. In common parlance, high dosages of primary lime are said to "set the color".

Ossining, N. Y. Experience

For many years the Ossining raw water was very difficult to treat. Color removal was poor if primary lime was applied, for reasons above stated. Since the raw water alkalinity always ranged 14 to 18 mg/L, this limited alum dosage to about 20 mg/L, which was barely sufficient to produce a heavy-bodied quick-setting floc with good color adsorptive properties. Treated water on top of the filters was very low or virtually devoid of alkalinity (1 to 5 mg/L), thereby risking the passage of alum through the filters. The application of secondary lime to raise pH and alkalinity of the finished water to inhibit corrosion, formerly resulted in pH values of 8.6 to 8.8 being attained with a resultant alkalinity of the finished water of only 12-20 mg/L. pH values in excess of 8.8 impart a rather "flat" taste to the water, which is objectionable in this section of the country, and the alkalinity of 12-20 mg/L was too low to inhibit corrosion in spite of the relatively high pH.

Thus from the standpoints of coagulation and corrosion control the problem at the Ossining plant has always been that of inability to apply a greater amount of alkaline calcium salts, without objectionably raising pH. In other words, the need has been for a greater amount of calcium bicarbonate, and the difficulty was how to supply this without unduly raising pH.

Another separate and distinct operating difficulty at Ossining has been that of taste and odor. About ten years ago "superchlorination" was instituted, and this treatment was maintained for several months. Though results were generally gratifying, several periods of intense taste and odor (probably augmented by this type of treatment) necessitated abandoning this procedure. Thereafter the "excess chlorine" type of treatment was instituted; it consisted of the addition of several mg/L of chlorine in excess of superchlorination requirements. Normal chlorine applications prior to superchlorination were about 2 mg/L, and during the period of superchlorination these were increased to 4 to 5 mg/L.

The excess chlorination treatment at Ossining has required dosages of 8 to 12 mg/L, and the rate of application is governed by the free chlorine residual of the filter effluent. This must be from 2.0 to 3.0 mg/L. It is then necessary to dechlorinate (SO_2 is employed) to residuals of 0.3 to 0.5 mg/L, otherwise severe taste and odor difficulties are experienced on the distribution system.

It has been found by experience that the excess chlorine treatment will: (1) bleach color in the raw water from values of 30-40 to 5-10 mg/L; (2) substantially eliminate all taste and odor if sufficient aeration is effected to remove the nitrogen trichloride and other biproducts; and (3) oxidize iron and maganese to insoluble precipitates which are removed by the filters. The Ossining plant has operated continuously over the past nine years with the excess chlorination treatment, supplemented by alum coagulation about 40 per cent of the time when this was required for greater color removal.

Effect of Chlorination on Alkalinity

The application of 8-12 mg/L of chlorine introduced another distinct problem as far as alkalinity is concerned. The chemical reactions involved are as follows:

$$\overset{70}{Cl_2} + \overset{18}{H_2O} \rightarrow \overset{36}{HCl} + HOCl \quad (3)$$

$$HOCl \rightarrow H^+ + OCl^- \quad (4)$$

$$\overset{72}{2HCCl} + \overset{100}{Ca(HCO_3)_2} \rightarrow CaCl_2 + 2H_2O + \overset{88}{2CO_2} \quad (5)$$

From these equations, it is evident that: 1 mg/L of applied chlorine forms 0.51 mg/L of hydrochloric acid, which requires 0.71 mg/L of bicarbonate alkalinity (as equivalent $CaCO_3$) for neutralization. Thus the application of 10 mg/L of primary chlorine reduces the alkalinity of raw water 7 mg/L and adds 0.63 mg/L of carbon dioxide. During periods when high dosages of primary chlorine were applied, the alkalinity of the Ossining finished water was so low that the application of secondary lime, though resulting in a pH of 8.6 to 8.8 still left a deficiency in alkalinity from the standpoint of corrosion control. In order to effectively control corrosion

the alkalinity of the finished water should be at least 30 mg/L and preferably 35 to 40 mg/L. This conclusion has been verified repeatedly in corrosion studies of the Ossining and similar waters. Values below 15-20 mg/L generally results in "red water" on the distribution system regardless of pH—even if sodium silicate is also applied as a corrosion inhibitant.

In summary additional calcium bicarbonate was badly needed to improve flocculation, to provide the alkalinity depleted by excess chlorination, and to maintain sufficient alkalinity in the plant effluent to inhibit corrosion on the distribution system.

Methods of Increasing Alkalinity

There are a number of ways in which lime can be converted into calcium bicarbonate, and naturally all require carbon dioxide. Some of the methods considered or tried at Ossining are as follows:

1)—A lime feeder could have been installed at the head waters of one of the brooks feeding the reservoir. This would have raised alkalinity and pH of the brook water, and ultimately the reservoir water. The pH would have gradually decreased during the several months of storage due to adsorption of CO_2 at the water surface from the atmosphere. This application, though practical, could not be effected since the stream bed would have been covered with lime deposits thereby impairing its esthetic value to adjacent property owners.

2)—A lime suspension could be continuously aerated (by means of carborundum diffuser tubes) in a large open basin. Atmospheric carbon dioxide would have then convert the hydrate into carbonate—and ultimately into bicarbonate form. The cost of the required amount of air under pressure was prohibitive, also the time of detention was too long for practical usage.

3)—Carbon dioxide gas could be bubbled under pressure through a milk of lime solution (or suspension), thereby quickly converting the calcium hydrate into calcium bicarbonate. The cost of carbon dioxide in either the gaseous or solid form was rather prohibitive.

4)—Several years ago, about fifteen tons of lime were piled in furrows on the reservoir ice cap during the winter months. When the ice cap melted, the lime came into intimate contact with the reservoir water, and it is probable that a good portion of the lime dissolved before reaching the muck bottom of the reservoir. This raised alkalinity of the entire reservoir water about 12 mg/L, and continuous exposure of the water surface to atmospheric carbon dioxide enabled an increase in alkalinity without objectionably high pH. This operation was therefore successful, although the alkalinity naturally diminished to normal during the next three or four months due to dilution by runoff. Summertime application could have been made by applying lime with a power boat; however, since lime is relatively insoluble, it would have to be applied in the dry powder form. Besides being difficult, this is hazardous as lime is a painful eye irritant.

None of these or other conventional methods for increasing bicarbonate alkalinity seemed sufficiently promising for routine procedure.

About twelve years ago, finely ground Calcite was applied to the raw water preceding the point of alum application in an attempt to raise alkalinity with a carbonate. Since Calcite is relatively insoluble in water, only a small portion went into solution, with the bulk dropping out at the inlet end of the sedimentation basins. The slight increase in alkalinity was insufficient to maintain desirable alkaline levels either in water on top of the filters or in the plant effluent after the addition of lime.

The overall problem was next approached along lines of preventing or diminishing depletion of the natural bicarbonate alkalinity by alum and chlorine. This approach ultimately led to a much better solution than would have resulted from merely being able to raise the calcium bicarbonate content of the raw water.

Calcite Characteristics

Calcite is primarily calcium carbonate, which is the principal constituent of limestone. Whereas there are innumerable outcrops of limestone in this country and throughout the world, they vary greatly both in terms of calcium and/or magnesium carbonate, and in terms of percentage of extraneous minerals such as silica. A high calcium, low magnesium, low insoluble content limestone, is preferred in the manufacture of lime for waterworks use. This preference is due to the relatively low solubility of calcium carbonate, which enables the formation of a protective pipe coating. Magnesium carbonate, although alkalinity, is too soluble to form such coatings. Limestone deposits may be essentially calcareous or essentially dolomitic, with many inbetween gradations. Some limestones, such as marble, are relatively soft and dissolve readily in acids. Others, such as Iceland Spar (a very pure calcium carbonate), dissolve slowly in strong acids even when heat is applied.

The limestone outcrop near Newton, N. J., is highly calcareous and highly crystalline, with relatively low silica and other insolubles. From these quarries, Limestone Products Co. of Newton produces lime for industrial and water works use, and ground Calcite in many sizes for uses varying from roof coatings to poultry feed. Their finest size of ground Calcite now marketed as "Aqua-treat" is air-separated, with about 95 per cent passing a 325 mesh seive. Up to the present time this material has been used principally as an industrial filler. In terms of hardness and solubility in acids it lies about midway between soft marble and Iceland Spar. It was believed that this product might be employed by premixing with dissolved alum in concentrated solution, provided the reaction was limited and controlled.

Alum Floc Composition

It is well known that floc formed by the reaction of alum and natural waters is an exceedingly complex compound. Pure aluminum hydroxide floc has an isoelectric point, or pH of minimum solubility, lying in a rather narrow and low range as was demonstrated by Thierault and Clark* in 1923. Their conclusions were ". . . when other possible factors are left out of consideration . . . optimum conditions for floc formation will be found with a narrow zone of pH centered for dilute solution at pH 5.5".

Two years later Lewis P. Miller,** dealing with flocculation involving calcium and magnesium carbonates and sulfates (and other dissolved and suspended matter) noted the decided difference between pure aluminum hydroxide, and the floc normally formed

*U.S. PHS. Reprint No. 813
**U.S. PHS. Reprint No. 992 and 1028

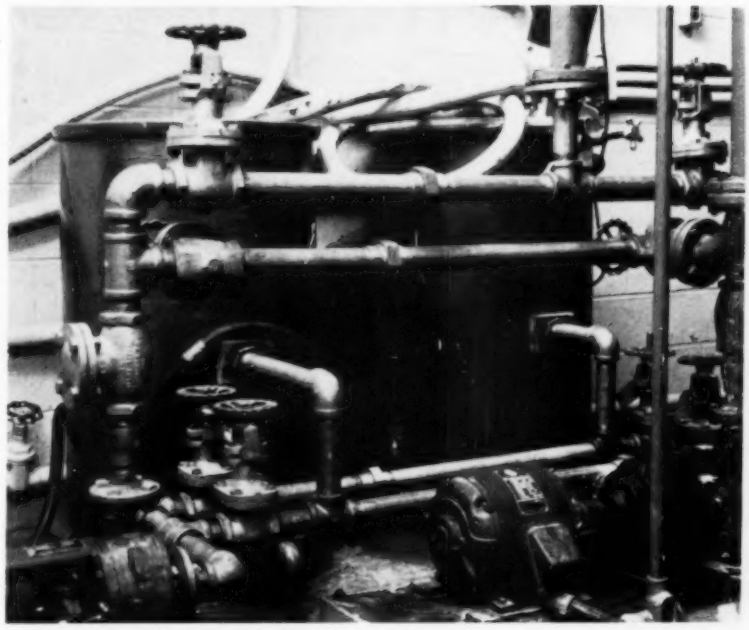
by the reaction of alum with natural water. He refers to ". . . that complex substance commonly called alum floc and often incorrectly termed aluminum hydroxide". Miller correctly concluded that "1)—there must be added a certain minimum quantity of aluminum ion; 2)—there must be present an anion of strong coagulating power such as the sulfate ion; 3)—the hydrion concentration must be properly adjusted."

The sulfate and other ions of natural raws waters decidedly influence the pH at which full bodied, highly adsorptive, and tough floc can be produced. At Ossining for instance the pH of the treated water following the application of alum must be in the range of 5.6 to 6.6 for effective coagulation.

The conventional application of alum depresses pH of natural waters in two ways, (1)—by lowering the natural alkalinity, and (2)—by forming carbon dioxide which itself suppresses pH. If alum is applied to raw waters before aeration the carbon dioxide formed is largely eliminated by this process—resulting in a higher pH than is normal if alum is applied following aeration. In the latter instance most of the carbon dioxide formed (say 5 to 15 mg/L) will remain in solution during passage of the treated water through the sedimentation basins and filters. Since the pH range for optimum coagulation is fairly narrow—generally from 0.5 to 1.0 unit of pH in the range of pH 5.6 to 7.0, it follows therefore that alum dosages must be governed to a large extent by this condition rather than dosages being proportioned in accordance with the amount of color, iron and other constituents which must be removed in the treatment process.

Floc Formation

If sufficient lime, soda ash or other alkali is added to say a ten per cent solution of commercial alum, copious floc is immediately formed due to the mass action occasioned by these high concentrations. If this floc is then discharged into raw water at a rate equal to a dosage of say 30 to 40 mg/L (of commercial alum), little or no adsorptive power is evidenced, and more often the floc will be broken up, and remain in a highly dispersed or peptized state—which would result in poor settling and large amounts passing the filters.



CHEMICAL MIXING CROCKS receive discharge from alum and Calcite dry feeders and the primary chlorinator. After a limited reaction period of 30 to 60 seconds, the solution-suspension is pumped to the raw water either before or after aeration.

Floc formation is a highly complex mechanism and probably involves first the agglomeration of jelly-like masses of microscopic or ultra-microscopic size building around physical particles such as silt or algae. From the outset this build-up is heavily influenced by the electrical charge of the cations and anions inherent to the original nucleus, the flocculating agents per se, and the electrical charges characterizing the dissolved and/or suspended mineral or organic matter contained in the raw water.

The presence of a starting nucleus is evinced by the difficulty often encountered in coagulating very clear waters almost devoid of turbidity and the great improvement often noted by the addition of a few parts per million of clays such as Bentonite. As the minute floc particles grow to larger sizes—first to the microscopic and then to the macroscopic stage, there must be a continual adsorption of color colloids and of course iron, if it is also present in the raw water.

The role of sulfates in this primary building stage is rather vague—but sulfates are a part of the complex substance collectively termed floc. The build-up of these microscopic particles into larger units is principally for the purpose of producing a relatively large discrete particle having good settling characteristics (on account of size) and having characteristics of toughness which will result in these flocculant masses being retained at or near the surface of a filter, rather than penetrating or passing through the sand. The build-up of pin-point size particles to those pin-headed in size (and larger) is of course a function of the number of particles which collide or coalesce while in the mixing basin.

Calcite—Alum Reaction

It was believed that the Newton Calcite, being relatively insoluble, might be successfully combined with a strong solution of alum, provided that the time of detention was so limited as to prevent the reaction from going through to completion, and further provided that mechanical agitation during this reaction was sufficient to prevent the microscopicly sized floc particles from coalescing and agglomerating into large masses. It was also believed that the chlorine solution from the chlorinator, due to the mass action of the strong solution would also react with the Calcite to form a type of hypochlorous acid or alkaline hypochlorite. The reaction of

aluminum sulfate and Calcite is as follows:

$$(6)\quad \underset{600}{Al_2(SO_4)_3} + \underset{300}{3CaCO_3} + 3H_2O = \underset{156}{3CaSO_4} + \underset{132}{2Al(OH)_3} + 3CO_2$$

Thus 1 mg/L of commercial alum would require 0.5 mg/L of Calcite, forming 0.26 mg/L of aluminum hydrates and 0.22 mg/L of carbon dioxide. If the three molecules of carbon dioxide combine with excess Calcite instead of being evolved as a gas, then 1 mg/L of aluminum sulfate could react with 1.0 mg/L of Calcite —forming as end products calcium sulfate, aluminum hydrate and calcium bicarbonate.

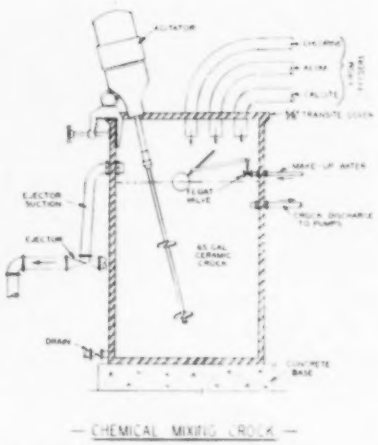
The reaction of chlorine with Calcite would be:

$$(7)\quad \underset{140}{2Cl_2} + 2H_2O + \underset{100}{CaCo_3} = CaCl_2 + H_2O - \underset{44}{CO_2} + 2H^+ + 2OCl^-$$

In the above reaction 1 mg/L of chlorine would therefore require 0.71 mg/L of Calcite, with the formation of 0.31 mg/L of carbon dioxide. If the CO_2 formed by this reaction also reacted with excess Calcite, then 1 mg/L of chlorine would react with 1.42 mg/L of Calcite and raise alkalinity in the amount of 0.71 mg/L for each mg/L of chlorine added. This reaction would be as follows:

$$(8)\quad \underset{44}{CO_2} + H_2O + \underset{100}{CaCO_3} = Ca(HCO_3)_2$$

The Ossining Plant (constructed about thirty years ago) is poorly designed by contemporary standards. There is no formal mixing basin other than an aeration tank 100 ft long and 50 ft wide which receives the spray from primary aerators—and which also has a 100 ft length of submerged carborundum tubes for additional aeration. Although the detention in this basin approximates more than two hours which is more than ample (or desirable) for floc formation, the high velocity of upwelling currents induced by the submerged aerators tends to break floc and prevent its build-up. The Ossining plant is therefore poorly adapted to a tryout involving a controlled reaction of alum and Calcite, or chlorine and Calcite; and this type of treatment, involving continuous flow as well as controlled reaction, could not be readily duplicated in a laboratory set-up. Since the Oneonta, N. Y., water works was then in the design stage in our office however, it as felt that a Calcite installation at Ossining would at least provide sufficient data for proper design of the flocculation facilities of the Oneonta Plant.



CROSS-SECTION shows design of chemical mixing crocks.

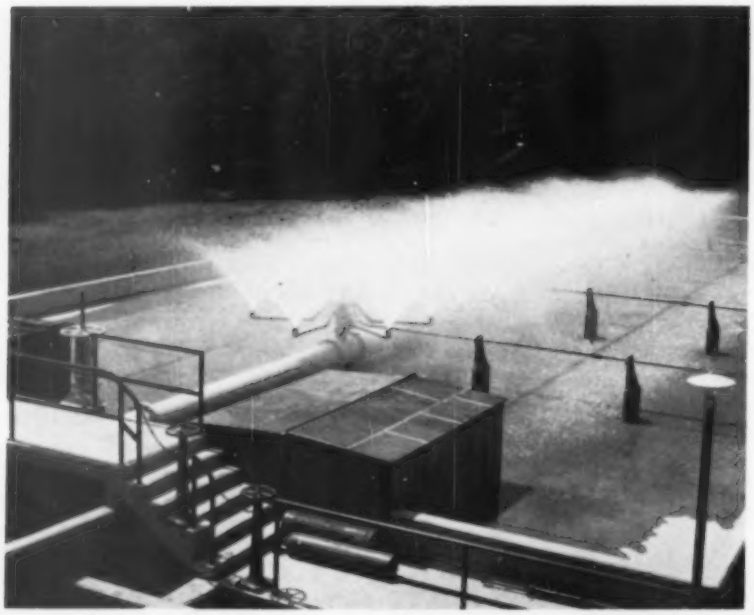
Experiments at Ossining

The discharge line from the Ossining chlorinator was therefore disconnected from the raw water inlet line, and connected to the solution pot of the dry chemical feed machine handling Calcite. The strong chlorine water reacted sufficiently with the Calcite to substantially neutralize the hydrochloric acid formed by the reaction of chlorine with water. The rate of Calcite feed was set sufficiently high to provide for reaction with the chlorine and also to leave sufficient excess to react with the normal alum dosage required for the 2 mgd of raw water flow. The discharge lines from the Calcite machine and from the alum feeder were then run to a crock in the basement—which was fitted with an agitator. After a detention period of thirty to sixty seconds the resultant solution was pumped to the raw water line before aeration.

In spite of the crude type of flocculation basin — designed essentially for aeration—floc formation and sedimentation showed considerable improvement over that normal to the conventional treatment of simply applying alum to the raw water line and relying upon natural bicarbonate alkalinity for floc formation.

Results Applied to Oneonta Plant Design

These operating results, though highly qualitative, were considered sufficiently promising to serve as a

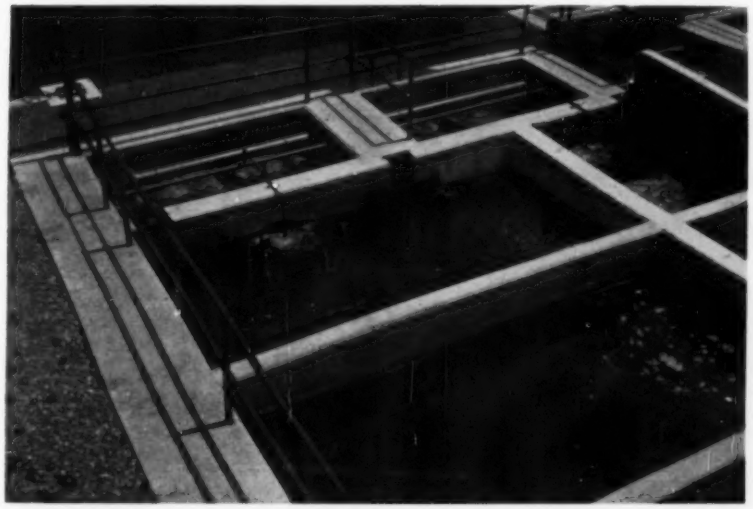


TASTE AND ODOR is controlled by high pressure aeration plus Aqua Nuchar. Calcite coagulation also reduces taste and odor by greater precipitation of algae and decaying organisms.

basis for design of all chemical feed and flocculating units of the Oneonta Plant.

The Oneonta Water Works has a raw water very similar in character to that at Ossining. Alkalinity is in the range of 13 to 16 mg/L, which definitely requires some type of primary alkali for the 20 to 30 mg/L of alum necessary for satisfactory floc formation and color removal. At Oneonta the discharge of the alum and Calcite machines are run by gravity to a sixty gallon crock located in the basement. (See accompanying photograph and sketch). This crock also receives the hose line from the chlorinator, and has a fairly tight asbestos-cement cover. In order to remove the slight chlorine vapors created within the crock (and which would be acute in the event that the Calcite feeder would through mechanical failure be put out of service), an Uscolite ejector was installed with suction connected to the top of the crock to remove chlorine vapors as formed. An agitator is installed in the crock to mix the three chemicals, to prevent the excess Calcite from dropping out and to prevent the floc from growing to more than microscopic sie. After a suitable detention period in the crock, ths solution or mixture is then pumped either to the raw water line before aeration or to the aerator flume preceding the flocculation basin. This of course constitutes a controlled chemical reaction, and as with most reactions, this is a function of concentration of chemicals and time. Discharging say 10 gpm each from the alum and calcite crocks and 20 gpm from the chlorinator, the detention in a 40-60 gallon crock should be in the range of 30 to 60 seconds with a solution (water) temperature of around 70°F. In the coldest months of the year with temperatures in the range of 35-40 the discharge from the alum and calcite dry feeders and the chlorinator should be cut about in half, and the detention in the crock increased from about 40-60 gallons to double or quadruple this value.

Operating experience shows that there is some tendency of the alum-calcite-chlorine mixture to form a coating in the 2-in. pipelines from the pump handling this mixture. Spectrographic analysis shows aluminum to be the major element with iron, silicon and titanium being minor. In still lower concentrations the sludge contains magnesium, sodium and calcium. Although the sludge can readily be removed by recirculating a 10 per cent inhibited hydrochloric acid solution, a preferable overall arrangement (if hydraulics permit) is to locate the discharge from the chemical feeders above the flow line in the plant so as to permit gravity discharge to the raw water. The chemical feed lines should have as short a run as possible to permit occasional manual cleaning with a wire brush similar to the type employed for boiler tubes. The mixing crock and agitator should then be located outside the control building. This also has the advantage of permitting the slight chlorine volatilized to escape to open air.



AIR-LIFT is used for floc feed-back to entrance end of flocculation basin. Twenty per cent of the heavily flocculated water from the third bay is returned to the first bay to furnish nuclei for initial floc formation.

The aeration flume extends the width of all three sedimentation basins and is 4 ft 6 in. wide and 3 ft in water depth. A 4¼ in. O.D. line of carborundum tubes is located the length of this flume and the forced aeration provides sufficient agitation to prevent the undissolved Calcite from dropping out and prevent the microscopically sized floc from further build-up.

The flume discharges into three flocculation basins, which form the head ends of the sedimentation basins. Each flocculation basin is divided into three bays, each 7 ft long by 19 ft wide, with a water depth of 11 ft 6 in. Each basin has two longitudinal Jeffrey type agitators. There are four paddle arms and four paddles on each agitator in the bay, four paddle arms and three paddles in the second bay, and three paddle arms and three paddles in the third day. This provides a tapering degree of agitation in the three bays, and multiple sprockets permit the flocculators to be operated at tangential speeds of 0.8, 1.0 or 1.2 ft per min.

There is a lapse of two to four minutes (at a treatment rate of 4.5 mgd for which the plant was designed, in accordance with New York State Health Dept. Requirements) between the application of alum to the raw water and its entrance to the first bay of the flocculation basins. Up to this point floc formation of appreciable size has been intentionally prevented by agitation in the crock, through the aerators, and through the aerated mixing flume. Upon entrance into the first bay of the flocculation basins the floc then seems "ready and willing" to form. The dosage of Calcite is such as to leave a residual after reacting in the mixing crock, and examinations with a stereoscopic microscope indicate a general reduction in particle size from 325 mesh, to particles sized about one-half or one-third their previous diameter. These small sized Calcite particles thereby furnish innumerable nucleii on which discrete particles of floc can form in their build-up. In addition to this they serve as a physical and mechanical weighting agent, and a microscopic

SIX PLASTIC WEIRS at effluent end of sedimentation basins assure a low velocity of approach, thereby increasing the efficiency of sedimentation in basins where the bottom in 11.5 ft of water can be clearly seen when operating at the design rate.

examination shows about ten to fifty pin-point sized Calcite particles enmeshed in each discrete particle of floc.

Plant Results at Oneonta

The overall results of this treatment are superior coagulation and a much greater immeshment of the colloidal turbidity (and algae) normally found in reservoir waters. The size of floc is generally somewhat larger than obtained at conventional plants under conventional methods of treatment. However, it has been found that color and colloidal turbidity removal is excellent whether resulting floc particles are moderately small, average or large. Color removal within the ranges encountered at Oneonta (20 to 45 mg/L) is substantially complete. Iron removal is also complete and no difficulty was occasioned by the recent cleaning of the raw water transmission line which resulted in iron concentrations for the first hour of operations each morning of from 0.5 to 5 mg/L.

In the Ossining pilot experiments it was not known whether the Calcite particles immeshed in the floc dissolved after the floc precipitated to the bottom of the sedimentation basin to form sludge. At Oneonta the sedimentation basins are provided with mechanical flight scrapers and blow-offs, which readily enable collecting samples of the precipitated sludge. Our observations show the tiny particles of Calcite immeshed in the floc are still undissolved several weeks after they have settled to the bottom as sludge. It is probable that they would remain undissolved for many months or almost indefinitely. At Oneonta this cannot be readily checked (in situ) as sludge is removed from the basins bi-monthly which of course always maintains them at maximum capacity from the standpoint of sedimentation efficiency.

The limited facilities at Ossining did not permit proper evaluation of the alum Calcite time detention factor or a determination of the optimum ratio of Calcite to alum. Based on twenty years of experience at this plant, and based on general laws governing flocculation, it was felt that both the time element and ratio of Calcite to alum would be critical. Operating experience at Oneonta during the summer months, however, shows little difference between one-half and one-minute of alum-Calcite mixing time and it has been found that a Calcite dosage anywhere in the range of 25 to 75 per cent of the alum dosage is effective in producing better floc. A ratio of about 50 to 75 per cent seem optimum however, since the greater dosages appreciably add more weighting material and result in a quicker subsidence of floc.

Ratio of Calcite to Alum

Naturally the greater the ratio of Calcite to alum, the higher will be the resulting pH of treated water in the flocculation basins. Jar tests of the Oneonta water employing the maximum amount of alum (about 25 mg/L) allowable for the limited natural bicarbonate alkalinity showed optimum floc formation to be in the range of 6.0 to 6.7. It was initially felt therefore that the Calcite dosage (or ratio of Calcite to alum) would have to be limited to that which would enable a comparable pH in the flocculation basins. Operating experience however proved that this is not the case. Floc formation is good to excellent at pH values as high as 7.3 and slightly above. A pH of 7.3 represents an alum dosage in the range of 20-25 mg/L with a ratio of Calcite to alum of 60 to 70 per cent. With the higher ratio, precipitation is markedly aided due of course to the greater number of minute Calcite particles which serve as a weighting agent. Operating experience also indicates that the carbon dioxide formed by the reaction of Calcite with alum, and with chlorine, is principally released to atmosphere at the liquid level of the crock, due undoubtedly to its supersaturation in this solution, as well as to the inability of carbon dioxide to react quickly with the relatively insoluble Calcite.

Sludge Behavior

Precipitated sludge from the alum-Calcite process exhibits rather unusual behavior compared with sludge produced by the reaction of alum with natural bicarbonate alkalinity. The blow-off line from the flight scrapers discharges to a drop-inlet manhole with a fall approximating ten feet. Thereafter the sludge passes at high velocity through a corrugated steel line several hundred feet in length before discharge to the brook. Samples of sludge collected after passage through this manhole and pipeline are therefore about as "beaten-up" as is possible. It is interesting to note however that if a two-liter beaker of this sludge is collected, the 7 to 10 per cent solids will completely reagglomerate and settle to the bottom

of the beaker within a few minutes time, leaving a clear supernatant. It would seem that ability to reform and clarify so quickly would have to be attributed to favorably charged cations and anions, resulting in considerable forces of attraction.

High Rate Operation at Oneonta

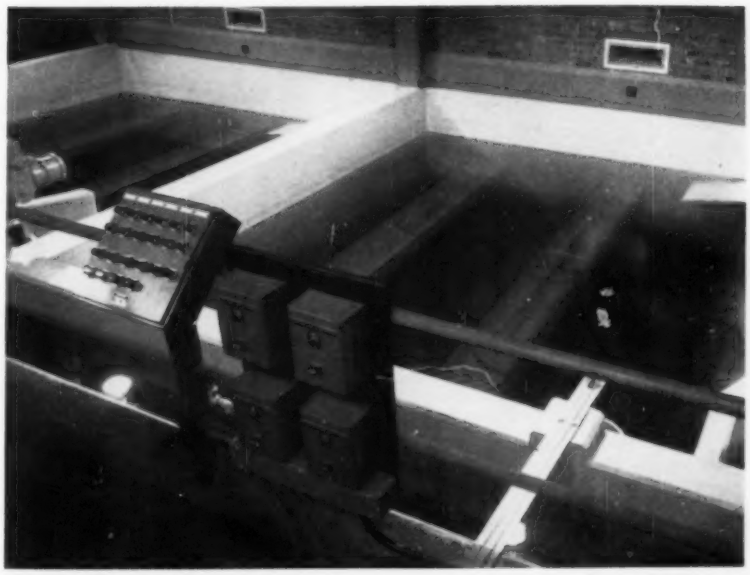
For its first few weeks in service the Oneonta Plant was operated at 4.5 mgd—the design capacity of the plant in accordance with conventional standards. The work at Ossining had been sufficiently indicative, however, to give rise to the hope that this coagulation process might enable a plant to operate at considerably greater than the design rate—hence all flumes, pipe lines, and other limiting hydraulic structures were designed for double the rated capacity, or 9.0 mgd. When the plant was operated at the design rate of 4.5 mgd the clarity of settled water at the effluent end of the sedimentation basins (six full-length weirs per basin were employed to assure very low velocities of approach) was such as to enable the cleaning mechanism located at the bottom to be clearly seen through eleven feet of water.

After about three weeks of operation at normal rate, the plant was stepped up in capacity by throwing in service an additional 2.5 mgd pump. Since the pumps discharge slightly greater than design capacity, the rate of pumping is in the range of 6.8 to 7.0 mgd. Mr. C. M. Taylor, Water Superintendent at Oneonta, has elected to operate at this higher rate since it naturally reduces the daily hours of operation by one-third, or from a twelve- to eight-hour operating day.

At the higher rate, color, iron and turbidity are reduced to a substantially immeasurable point by Standard Methods procedures. Filter runs are generally in excess of 24 and often in excess of 48 hours. The plant effluent is sparkling clear and has real polish. This is undoubtedly due to rather complete removal of colloids.

Taste and Odor Removed

Taste and odor removal has been excellent. During late August, September and October (1957) the reservoir was drawn down eight or nine feet which represents the height to which the old dam was raised some thirty years ago. This dam raising operation had flooded flat meadow lands, and with a drawdown of eight to nine feet, about one-quarter of the total reservoir water surface has a water depth no greater than about one foot. Needless to say, this water was green with algae and imposed on the plant a rather rigorous load from the standpoint of taste and odor removal. Aeration was relied on heavily to effect this improvement, the spray aerators being operated at a pressure of ten to fifteen psi—resulting in a spray height of about twelve feet. In addition to this about 2 mg/L of activated carbon (Aqua Nuchar) is normally applied.



CLARITY OF TREATED WATER, due to the virtual elimination of colloids, is such that the water troughs and sand beds in the filters can be seen during operation.

At one time during a test period, a minor break-down of the Calcite feeder necessitated discontinuation of Calcite and operation with straight alum, employing the natural alkalinity of the water as a source of primary alkali. Floc formation deteriorated materially and the colloidal content of treated water rose to the point where it was no longer possible to see the top of the filter sand or the wash water troughs. A slight though perceptible odor was also detected in the plant effluent although 2 mg/L of carbon was being applied. After two days of outage for repair, the Calcite machine was again placed in service. The colloidal turbidity disappeared and the odor was eliminated.

The relationship between Calcite and odor removal must lie only in the superior coagulation by Calcite and a greater removal of organic suspended solids (algae and decomposing growths of vegetation). This observation is also confirmed by the dosage and residuals of secondary chlorine. Primary chlorine is limited to a dosage sufficient to effect adequate sterilization of the raw water. This normally represents an application of 1.0 to 1.5 mg/L with residual of about 0.2 mg/L in water discharged from the aerator basin. This dosage must be a great deal less than is required to reach a break point. On the other hand, a dosage of 0.35 mg/L of secondary chlorine results in a chlorine residual very closely approaching this figure—showing that there is very little chlorine demand (at this oxidizing potential) filtered water.

Floc Feed-Back

It should be stated that at the Oneonta Plant another device is employed to aid further, the formation of floc. This is a floc feed-back system which returns about 20 per cent of heavily flocculated water from the effluent end of the third (last) flocculator bay to the entrance end of the first bay. The combined detention through the first three bays amounts to 33 minutes, or 11 minutes per bay at a rate of 4.5 mgd. It is believed

that this heavy bodied and aged (33 minute) floc is quite helpful in quickly building moderately heavy floc in the first bay. Air lift enables this return with a minimum break-up of floc particles.

It would seem that the use of the Calcite-alum process—and the flocculation feed-back process—would enable many existing well designed water works to be successfully operated at higher than normal ratings. This is particularly true for plants which have good flocculation facilities. The Calcite-alum process may also have considerable usage in improving the efficiency of sedimentation in upflow clarifier units, many of which have been designed with detention periods which proved too low, or conversely, upflow rates which proved too high. This would seem to be confirmed by the superior performance of upflow clarifiers when operated for lime-soda softening. The weighting of floc with natural Calcite should be quite comparable to weighting with precipitated calcium carbonate.

Both the Calcite-alum process and the floc feed-back systems are being patented. The process is quite economical as the cost of Calcite approximates one-half that of lime.

Ed. Note: Both the Calcite-alum and floc-feed-back processes, as well as many of the authors' statements were so interesting that we requested commentary from Mr. L. L. Hedgepeth, Technical Consultant to American Cyanamid Co. (and Editorial Associate of *Water & Sewage Works*) and Mr. George W. Moore, Chief, Water Supply Section of the New York State Health Dept.

Comments by L. L. Hedgepeth

Mr. Riddick's experience with relating floc formation to *quantity of alkalinity*, in addition to the intensity (pH), is borne out in his practice of coagulation. Many persons have explained the zone of optimum coagulation of alum in natural water as being a pH function, thus setting aside the earlier concepts of coagulation calculations. But Riddick finds that, under his conditions of experimentation, a minimum quantity of alkalinity must be present in order for the flocculation to be clean cut in the optimum pH range. Also it would seem that the presence of undissolved calcite should be helpful in starting the reaction which results in discrete floc particles, and the excess calcite per se may result in a beneficial modification of the essential chemical composition of the floc.

Similarly Riddick's conversion of chlorine water into an aqueous solution of hypochlorite through reaction with calcium carbonate is a new approach to water coagulation, although the reaction itself has been understood and practiced in water chlorination for more than twenty years. A number of chlorine investigators, including the writer, have advanced the idea that a hypochlorite chlorination is different from chlorine water chlorination in that the hypochlorite "oxidizes" where the chlorine water "chlorinates". Others hold that, in the dilutions of chlorine commonly used in water treatment, there is no material difference in the chemical behavior of hypochlorite and chlorine water solutions of equivalent strengths. But the writer's experience has indicated that there is a distinct difference between the two when chlorine is used as a chemical agent. Recent experiences with hypochlorite solutions versus chlorine gas in cyanide oxidation cause the writer to believe that the weight of the evidence favors the hypochlorine as being the most efficient.

Comments by George W. Moore

Calcite (fed separately from alum) has been used effectively in several upflow contact basins in New York State during the past four or five years but no real study has been possible of chemical reaction between Calcite and alum as a coagulant. However, the following physical observation have been made:

(1) The primary advantage of using calcite seems to be its weighting action in keeping slurry and floc from rising in the upflow basins.

(2) Jar tests and plant operating tests indicate that the floc formed when coagulating relatively clear cold water is stronger and will not break-up with a moderate degree of agitation.

(3) Although not established in the plant using Cacite in upflow coagulation, it is quite possible that the Calcite particles are enmeshed in the floc as observed by Mr. Riddick at Oneonta.

In plant operation at Oneonta, the method of applying the coagulant and Calcite in combination with chlorine is unusual. It will be interesting to learn whether or not similar results can be expected if the coagulant, Calcite and chlorine are applied separately as originally done in rapid sand filter plants. Based on experiences showing the effectiveness of the use of Calcite in solids contact basins, it has been my belief that Calcite would be of value in standard coagulation and settling basins.

(4) Coagulation jar tests conducted with water having somewhat the same physical characteristics as the raw water at Ossining and Oneonta but having a somewhat higher alkalinity, indicate that effective coagulation can be secured with a reduction in color and an increase in the size and toughness of the floc, providing the samples are agitated at a velocity sufficiently high to maintain Calcite in suspension. The floc also has excellent settleability due to the weighting action of the Calcite.

In jar tests using Calcite, there does not seem to be a tendency for the color to be set, consequently effective color reduction is secured by the use of Calcite with pH in the coagulated water between 6.9-7.0. Normally the water, when using alum alone, requires a pH of 6.4 to 6.5 for maximum color reduction.

I, for one, look forward to additional information, not only on the Oneonta experience but other plants including upflow contact basins, as well.

"Well, I'll be horn-swoggled! The wife and me had a little argument last night. As usual, she's won again!"

ONE OF 22 GUIDES explains how simple it is to position a meter or series of meters, on the test stand by means of a special steel framework, when NEWWA visited the . . .

Brand New Meter Factory *of Hersey Mfg. Co.*

EDITOR'S NOTE: Since 1885, Hersey has been making water meters. Last September, the company showed its new manufacturing quarters to visiting water works men attending the 75th annual meeting of the NEWWA. This is the story of what they saw and heard.

UNIQUE TESTING STAND for larger type meters is explained by its designer, Chief Engineer, George Harrington. Under test is an FM 6-in. meter.

■ NEARLY 100 years ago, in 1859 to be exact, the waters of Boston Harbor lapped at the back door of a machine shop at the corner of E and Second streets, South Boston.

That building still stands today albeit expanded, modified, stretched, braced and buttressed, but the shore line of Boston Harbor has crept quite a bit to the East.

Back nearly a century ago two men, Walter E. Hawes and Charles H. Hersey, formed a partnership, "Hawes and Hersey," for the manufacture of rotary pumps, bolts and general machinery. The shop built the first self-propelled fire engine for the City of Boston, operated by steam, and "not very successful," according to Walter A. Hersey, 78, president and nephew of the founder.

In 1870 the firm drew up plans for a sugar refining machine which revolutionized the industry. On the heels of this venture the shop started the sale and manufacture of water meters. Within the company's archives are faded records which contain information about every Hersey meter made, including Meter No. 1, which was sold to Wilmington, N. C. In the office of

the president is the company's three millionth meter, produced a few years ago. Also active in the company are Winthrop P., and Francis P. Hersey, respectively executive vice president and treasurer.

Until mid-summer of this year the Hersey plant in South Boston was the headquarters for the company. A second manufacturing and distribution outlet is situated in Monterey Park, Calif., with eight branch offices in principal cities.

Time to Move

Officials of the company determined that it was too much of a strain to continue manufacturing in the antiquated South Boston building. Also, the operation of a bronze foundry on the fifth floor, slow-moving elevators, and no room for expansion began to pose an efficiency problem.

Instrumental in aiding the Hersey firm to locate in an area where it could expand was the Dedham Industrial Council, a progressive group only four years old headed by John J. Flynn as chairman and Laurence A. Corbett as secretary.

The new plant, constructed by Aberthaw Construction Co., is situated on a nine and one-half acre tract at the corner of Elm street and Rust Craft road. The building, designed by Cabot, Cabot and Forbes Co., especially for the manufacture of a complete line of water meters comprises 150,000 square feet, and contains 12,000 square feet of air-conditioned general and executive office space.

The modern bronze foundry occupies 33,600 square feet of space and contains a unique mechanical sand-handling system and electrical furnaces. The 104,400 square feet of factory space is for the machining, assembling and testing of ⅝- to 12-in. meters.

Less than one per cent of the 450 employees failed to make the transition to the new plant in July. Months before the move, the Personnel Department aided in forming car pools and solved other transportation probblems for the employees, most of whom live in the South Boston area. Some employees have 50 years or more service with Hersey, and there are many father-son, relative, combinations.

Water Needed for Testing

As water for testing meters is used in huge quantities, Hersey dug its own well on its property, 120 feet deep and which supplies a 100,000 gallon underground concrete reservoir. The normal water supply is from the Dedham Water Co. and well water is used only for processing, cooling and testing.

The factory, the most modern manufacturing plant of its type in the country, has been designed for future expansion by utilization of metal wall panels. There are six truck docks for receiving and shipping and the area is completely palletized. All rooms in the entire layout are protected by automatic sprinklers and a paved parking area provides space for 200 cars.

An interesting point is that Hersey put a great deal of study into the

OFFICIAL GREETERS for visit of NEWWA members were (left to right), Winthrop P., exec. vice pres., Walter A., president, and Francis P., vice pres. and treas.

WOMEN have proved to be efficient operators on small machines, for making interior parts of meters.

building of a meter testing section for all types of meters. There are few places in the country capable of testing large meters up to a capacity of 12 inches and weighing two tons. Prime feature of the testing section is the minimum amount of time needed for both setting up and testing various meters.

Through the efforts of the Dedham Industrial Council the new Hersey plant erected a large neon sign on its rooftop which included the words, "Dedham, Mass." and thus became the first industry along the 70-odd miles of Route 128 Circumferential Highway to pay honor to the community in which it was located.

When all new industries have been absorbed by the Town of Dedham it is expected that more than $250,000 will be added each year to the town's income, with the net worth of the buildings and property adding to many millions.

The new Dedham neighbor conceived the plant so that it would take advantage of the most modern and efficient methods of materials handling, manufacturing techniques and machines.

The company's objective is the production of the best quality water meters at the lowest possible costs.

Drawing upon its century of experience, the firm has committed itself to a $2.5 million expansion program based on the belief that home building will increase substantially in the next ten years.

Hersey claims that it is the "most completely integrated water meter manufacturing company in the United States". Water-works men taking the guided tour were inclined to agree that this was not just an idle boast.

Howard E. Moses, Dir. Div. San. Engr. Pa., Dies

Howard E. Moses, Director of the Division of Sanitary Engineering in the Pennsylvania State Department of Health since 1942, and nationally-recognized as a pioneer in clean streams programs for his outstanding work in that field, died November 13, 1957, in the Reading, Pa. Hospital.

Mr. Moses, who had celebrated his 82nd birthday on October 15, suffered a heart attack in August of this year, but had returned to work at the State Health Department until again confined to a hospital in recent days.

He was the oldest full-time professional employee with the State Health Department, having joined the Department on June 8, 1908, as an Assistant Engineer.

Mr. Moses was born October 15, 1875 in Muhlenberg, Luzerne County, the son of a Methodist minister. He graduated from the Altoona High School and from Dickinson College, after which he studied for one year at the University of Maryland and, later, at the School of Hygiene and Public Health at Johns Hopkins University.

He had been a resident of Harrisburg since coming to that city in 1899 as a mechanical engineer with the Harrisburg Foundry and Machine Works.

In 1908 he joined the State Department of Health. In April, 1916 he became Chief, Water Works & Sewerage, and in December, 1922 was advanced to Assistant Chief Engineer. In September, 1933 he was appointed Assistant Chief Sanitary Engineer, and in November, 1937 was made Chief Sanitary Engineer. In the same month, he was appointed Acting Director of the Bureau of Engineering.

In November, 1942 he was appointed Director of the Bureau of Sanitary Engineering, the position he held at the time of his death.

From October, 1953 to June, 1954, Mr. Moses served as Acting Director of Environmental Health Services in the State Health Department.

In spite of the multitude of duties he performed as Director of the Division of Sanitary Engineering—including supervision of water supplies serving 8,000,000 people—Mr. Moses found time to take an active part in more than a dozen interstate agencies and technical organizations.

He participated for many years in the formation and organization of the Ohio River Valley Water Sanitation Commission, was Chairman of the Commission and Member of the Commission's Engineering Committee.

He was a member of the Quality of Water Committee of the Interstate Commission on the Delaware River Basin (INCODEL), a member of the Technical Committee of the Interstate Commission on the Potomac River Basin, a representative of Pennsylvania on the Great Lakes-Upper Mississippi River Board of Engineers, and an active member of the Conference of State Sanitary Engineers.

Mr. Moses was a Life Member of the American Society of Civil Engineers; a Life Member (and former Chairman of the Pennsylvania Section) of the American Water Works Association; participated in the formation of the Federation of Sewage and Industrial Wastes Associations, and for thirteen years was Secretary, then Director, and most recently an Honorary Member of the Federation.

He was former President of the Pennsylvania Water Works Operators' Association; a former Director and President of the Pennsylvania Sewage and Industrial Wastes Association; and a former Secretary and for two terms President of the Engineers Society of Pennsylvania.

Among the honors and awards bestowed on Mr. Moses for his achievements were: an Honorary Degree of Doctor of Science from Dickinson College (1953); the Fuller Award of the American Water Works Association (1949); and an Award of Merit from the Pennsylvania Public Health Association (1955).

The Federation of Sewage and Industrial Wastes Associations conferred on him the Kenneth Allen Award (1945), the Charles Alvin Emerson Plaque (1951), and Honorary Membership (1943).

At State College, Pa. in August featured a symposium on . . .

Trickling Filter Operation

Ed. Note: This report on the annual meeting of the Pa. SIWA (as well as the report on the Pa. WWOA meeting) in August of 1957 had been planned for the November issue by our late Editor, Linn Enslow. An attack of Asian Flu altered those plans and his untimely death in early November also changed the plan to include the report in the December issue. The report on the trickling Filter Symposium by Dr. Symons had been held by Mr. Enslow hoping to include it with his own material. Since that part of the report was prepared and since it contains a number of interesting observations by trickling filter operators, it is published at this late date, with apologies to our readers for the delay. Also included in this report are a number of abstracts from Mr. Enslow's notes on the other sessions of this meeting. They represent one of the last meeting reports on which he was working at the time of his death.

■ TRICKLING FILTER PERFORMANCE was reviewed and discussed with particular reference to six plants in a session that occupied half of the final session of the meeting. This symposium was presided over by George A. Elias of the Penna. State Health Dept. Three of the papers dealt with industrial waste filters and three with municipal waste installations.

E. P. STREET, Waste Control Engineer, Merck, Sharpe and Dohme, at West Point, Pa., described the problem and installation at his plant, where approximately 2000 lb per day of B.O.D. are loaded on two trickling filters of 1000 cu yd each.

When the industrial plant began operations, the wastes were from chemical treatment processes; now the plant manufacturing processes involve biological production and the type of waste has changed. Although the manufacturing processes have twice the former output, the load on the trickling filters is only 70 per cent of design and there are no chemical poisons with which to contend.

Recirculation is practiced in both stages: the ratios being 3 to 1 in the first stage and 2 to 1 in the second stage filter. The raw waste loading is 1940 lb per day and the first stage is operated at a loading rate of 2200 lb per day, with approximately 78 per cent removal. The second stage filter operates with a load of 480 lb per day and accomplishes a 36 per cent reduction in B.O.D.—The final effluent contains approximately 9 mg/L of B.O.D.

A. A. Estrada
Prog. Chair

K. S. Watson
FSIWA Pres.

In the winter, the second filter operates at a lower efficiency than in the summer, but the first stage is about the same the year around. Nitrates in the effluent run from 15 to 25 mg per L. Once when a chromium waste was discharged (about 1 mg/L) the B.O.D. of the effluent increased to about 22 mg/L. Mr. Street concluded that the two-stage Bio-filter did a good job with both chemical and biological wastes.

DEWAYNE DAY, Supt. of Water and Sewage at Meadville, Pa., explained the problems of treating wastes from the manufacture of sauerkraut, pickles and peppers. These wastes contain vinegar, brine, lactic acid, etc.

A pilot plant study on the treatment of these wastes indicated that maximum B.O.D. reduction was obtained at a pH of 6.5; chlorides up to 5000 mg/L had no effect on B.O.D. reduction; if the recirculation was greater than 40 per cent of the total applied load, the efficiency dropped off; and lastly, the sludge obtained from the filter sloughing dried well.

As a result of these pilot plant studies, an abbreviated plant was built with a lagoon in place of sludge facilities. Early operation produced ponding on the filters. At that time the B.O.D. loading was 1585 lb per acre foot per 9-hr day. An average of 70 per cent removal of B.O.D. was obtained. Recycling was practiced whereby the recirculation averaged 60 per cent of the raw waste B.O.D. loading. Some odors are produced in the lagoon and these are reduced by using hypochlorites.

TOM IEZZI, Sanitary Engineer of Rohm & Haas Co., Bristol, Pa., described a problem involving mixed organic wastes and low pH.

These wastes are first treated with soda ash to raise the pH to 7.5-8.5. These wastes contain no setting solids and the B.O.D. of 2200 mg/L is mostly due to volatile organic matter. These wastes need no nutritive additives since they contain approximately 70 mg/L of phosphorus, and 110 mg/L of nitrogen.

The total B.O.D. load is 14,000 lb per day. Since it comes from many sources, it is first passed through an equalizing basin before going to the trickling filter. Two filters, 220 ft in diameter and 5 ft deep, contain 6000 cu yd of stone and have no walls, but a graded slope.

The first stage filter is loaded at 16.8 mgd and has a recirculation rate of 14.3 to 1; the second stage is loaded at the rate of 17.2 mgd and has a recirculation rate of 5.3 to 1.

The B.O.D. loading of 14,000 lb per day amounts to a loading of 2000 lb per acre ft. Reduction of B.O.D. is 72 per cent in the first stage and 66 per cent in the second stage. The total overall removal of B.O.D. is 92 per cent.

In summer, the removal in the first stage goes as high as 98 per cent. This result is obtained by operating the filters in series—parallel, with 20 to 25 per cent of the raw waste going directly to the second stage. Under this type of operation the second stage reduces the B.O.D. by 92 per cent in that stage while the first is showing a 98 per cent reduction.

The effluent of the filters goes to a lagoon where some chlorine is added for the purpose of combatting any possible tastes and odors that might show up in water supplies downstream. In the winter, the speed of the distributing arms of the filters is

reduced to obtain better operation.

JOHN K. HALLENBURG, Sanitary Engineer, Hill & Hill Engrs. of North East, Pa., presented a story on the operation of the municipal plant of that community where the wastes from four fruit canners and one milk plant are taken into the municipal sanitary sewers.

In 1935, with a city population of 5000, the wastes had a population equivalent of 6000. By 1948 the industrial wastes were seven times the sewage plant capacity and had a strength of 40,000 population equivalent, with peak B.O.D. loads being equal to 60,000 persons.

W. B. Bennewait

W. E. Sacra

N. Bruno

W. W. Willis

Operators Symposium

Paul Cygan

J. S. Hendershot

The B.O.D. of the wastes run from 1000 to 3000 mg/L and come from the processing of cherries, grapes, tomatoes, and milk. During the late summer season, when the fruit is being picked and processed most of the load on the plant occurs. During this time 95 per cent of the cherry wastes, 85 per cent of the tomato wastes and 65 per cent of the grape wastes reach the plant. The remainder of these wastes loads is spread over the year. As a result of this heavy concentration of load in a short season, the filter operation deteriorates during that time, but it recovers during the winter.

Following a pilot plant study at Welch's Grape Juice plant, which handles its own wastes, it was decided to add a high-rate trickling filter to the municipal plant, ahead of the standard rate trickling filter which had been operating for several years. At Welch's plant it was found necessary to lime the wastes before treatment, otherwise the filter would not withstand shock loads and efficiency was reduced.

The new plant designed for the Welch factory is designed for loading at 2 to 4 lb of B.O.D. per cu yd. The new municipal high rate filter can be loaded at the same rate. Based on the pilot plant studies at Welch and the observations of filter operation in the municipal plant, it was decided that only a trickling filter can handle such high organic loads and shock loads. Hence the installation of the new high rate filter in both the municipal plant and the Welch plant.

TRACY W. GREENLUND, Operations Engineer of Glace & Glace, Inc., Harrisburg, Pa., reviewed the operations at the municipal plant in Easton, Pa., where there are two trickling filters, 160 ft in dia and each 4.4 ft deep.

Recirculation is practiced in a ratio of 2 to 1; the underflow from the primary filter is split ½ to the primary influent and the overflow of the final tank is split with ½ to the filter influent and the remainder discharged. Recirculation ratios of 2.5 to 1 have also been used.

The strength of the wastes is high, the B.O.D. running from 458 to 512 mg/L and the suspended solids running from 369 to 380 mg/L. The primary clarifier accomplishes a 58.6 per cent reduction in the load applied; the filters reduce the applied load by 81.6 per cent; the filters and secondary clarifier accomplish a total removal of applied load of 89.1 per cent; and the overall efficiency of the plant accomplishes a 95.8 per cent reduction in the raw load. Mr. Greenlund believes that the high overall efficiency is largely due to the high efficiency of the primary clarifier.

L. M. MOYER, Supt. of Sewage Treatment Works in Mechanicsburg, Pa., spoke about the operation of his plant where the B.O.D. concentration is approximately 300 mg/L and where an overall reduction of 95.6 per cent is obtained.

Reduction of suspended solids averages 93.7 per cent in the plant. With a volume of 0.72 mgd and a total B.O.D. load of 393 lb per day, the trickling filter is operated at a rate of 11.1 mil gal per acre per day. The final effluent from the plant contains only 13 mg/L of B.O.D.

ORP in Waste Treatment

DR. WERNER N. GRUNE, Assoc. Prof. of Civ. and San. Eng. at Georgia Institute of Technology, Atlanta, Ga., presented a paper authored by himself and Chun-Fei Chueh, a Research Asst. at the Institute. The paper was titled, "Redox Potential in Waste Treatment—Laboratory Experiences and Applications."

Dr. Grune described the parameters for sludge digestion—gas, volatile acids, pH—and pointed out that these were "after the fact" and therefore suffered weaknesses as determinations for the actual control of the process of digestion. This particular study was started in connection with studies on the effect of atomic energy wastes wherein some means was sought to ascertain what was happening at the instant of occurrence in digestion.

The paper described the redox potential measuring device, its construction, operation and difficulties of operation. These difficulties result from the problem of poisoning of the cell and polarization in sludges. The particular cell described is manufactured by Fischer and Porter Co. of Hatboro, Pa.

Among the observations made by Dr. Grune was the fact that the cells must be standardized and must be maintained by thorough cleansing. In some instances, it is found that it requires 2 hours to obtain a stabilized reading. Dr. Grune believes that the oxidation-reduction process may occur in stages. In order to obtain equilibrium quickly, Dr. Grune used iodine-iodide.

In the digestion tank it is apparent that layering occurs and the ORP is different in the different layers. Temperature also affects ORP and it was observed that the ORP of raw sludge may vary from +85 to —25. The whole matter of ORP is still not thoroughly understood.

W. W. ECKENFELDER, JR., Assoc. Prof. of Civ. Engr. at Manhattan College, New York, discussed the paper and showed two examples of the use of ORP use. In the case of an activated sludge plant operation, the Redox potential indicated when the D.O. disappeared, but one of the problems, was that continuous ORP does not measure only dissolved oxygen; it also depends on organic material undergoing biochemical change.

S. E. Kappe
Sup. Liquor

J. A. Tapleshay
Tot. Oxidation

Mr. Eckenfelder showed an example of how ORP determinations are ideal for oxidation of chemical systems. In such a case, it is possible to control the operation of the process by ORP. The example cited involved sulfur dioxide, thiosulfite, and sulfides. In the oxidation of sulfides and thiosulfites to sulfites, the Redox potential shows a large change for a small change in concentration of the chemical constituents.

(*Ed. Note:* The following material has been taken from Mr. Enslow's notebook.)

Other features of the meeting included a Sewage Operators' Roundtable, participated in by six operators.

WILLIAM E. SACRA, JR., Supt., York, Pa., reported that elutriation had been discontinued at his plant because of overall costs.

NICHOLAS BRUNO, Act. Supt. Verona, Pa., stated that digester supernatant liquor could be conditioned by aeration without the presence of waste activated sludge.

WILBUR W. WILLIS, Supt. Engr., Fairless Hills, Pa., handles starch waste in his activated sludge plant with 5 cu ft of air per gal, has no waste sludge, and reduces the B.O.D. from 360 mg/L in the raw sewage to 18 mg/L in the effluent.

PAUL CYGAN, Supt., Erie, Pa., reported difficulties with shearing pins in the cross collectors for sludge in the primary tanks. By reducing the return of activated sludge to hold sludge solids at 5 per cent (it is 2 to 2½ per cent without activated sludge) the shear pin trouble was eliminated.

JOHN S. HENDERSHOT, Supt., Williamsport, Pa., reported trouble with a pneumatic scum ejector operating with a pressure of 20 psi in the air pot; it was necessary to adjust the tension on the diaphragm spring almost continuously.

MR. FRAZIER of Chambersburg, Pa., spoke on how to charge for industrial waste treatment in a municipal plant. For three milk plants averaging a B.O.D. concentration of 3189 mg/L and one chicken plant, a charge was set up based on B.O.D. and sludge solids. Current income on this basis is $6000 a month compared to $600 a month on the old basis.

G. A. Elias
Past Pres.

B. S. Bush
Pres.

H. W. McElhaney
1st Vice Pres.

J. R. Harvey
Secy.

Extended Oxidation

In recent years, one of the interesting development of the activated sludge process has been the work done on the use of extended aeration or total oxidation. Three investigators who have worked on this process presented papers at this meeting.

DR. ROSS E. MCKINNEY, Asst. Prof. San. Engr., Mass. Inst. Tech., described his experiments and the industrial waste treatment plant he had designed; he gave operating results for that plant where high loads are handled with no waste sludge, using 23 hour aeration.

JOHN A. TAPLESHAY, Mgr., Ind. Equip. Div., Chicago Pump Co., pointed out that the process was at least 18 years old. His company designs and sells package plants using this system under the trade name "Rated Aeration". Mr. Tapleshay showed design characteristics, gave data on air requirements, construction costs and operating results.

PROF. R. R. KOUNTZ, Prof. of San. Engr., Penn State Univ., delved into the fundamental chemistry of the processes by showing these equations:

(1) Anaerobic Oxidation of organic matter
$$CHX + H_2O \rightarrow CO_2 + CH_4 + X$$
(2) Aerobic Oxidation of organic matter
$$CHX + O_2 \rightarrow CO_2 + H_2O + X$$
(3) Oxidation of Bacteria
$$\text{Bacteria} + O_2 \rightarrow CO_2 + H_2O + X$$

In order to apply the total oxidation process, it is necessary to know the total oxygen demand including that of the bacteria. Prof. Kountz showed his design of equipment for aeration in a total oxidation system pointing out that simplicity and economy are the key criteria.

Digester Supernatant Liquor

S. E. KAPPE, of Kappe Assoc. in Washington, D. C., presented a problem of supernatant liquor from sludge digesters. Solutions to the problem, said Mr. Kappe include (1) concentrating the raw sludge before introducing it into the sludge digester: (2) improved decanting systems, either by well screen separation of solids from liquid, or by heating to improve liquid-solid separation; and (3) control of digestion.

Mr. Kappe referred to the bulking problems in activated sludge plants and drew an analogy to poor separation of solids from liquid sludge digesters. He believes the key to the difficulty is the content of phenol in both cases and he presented data showing the increase of phenol content of activated sludge over that of the raw sewage. In anaerobic sludge digestion he also found an increase of phenol in the digested sludge over that of the raw sludge. The concentrations increases range from about 3 to 7 parts per billion.

For the treatment of supernatant liquor, Mr. Kappe recommends (1) spreading (2) oxidizing agents (3) aeration, and (4) discharge to trickling filters.

(The meeting also held a "control analysts breakfast and one session devoted to an industrial waste round table with no papers presented and one session to four industrial waste papers; these will be reported in the January issue of *Industrial Wastes.*)

SEWAGE WORKS PRACTICES

Sewage Filters

The ninth of a series of articles

THEODORE JAFFE, Professor of Civil Engineering at Alabama Polytechive Institute, Auburn, Ala. writes for the practical plant operator, on matters of interest often overlooked in the press of routine duties.

TREATMENT of sewage on filter beds has been practiced for many years, the beds usually producing a high quality effluent with a minimum of operation and maintenance.

There are two main classes of filters—sand filters and trickling filters. The trickling filters have been developed in various ways, each having its own name. However, trickling filters are usually classified as (a) low-rate or standard-rate filters, (b) high-rate filters without recirculation, or (c) high-rate recirculating filters. This last type has many flow patterns, as will be shown later.

All of these treatment devices operate on the same basic principles. They are usually preceded by primary sedimentation tanks to remove the solids from the liquid, although some treatment plants have Imhoff tanks for this purpose. In either case, the effluent from these sedimentation units is applied to the filters. All types of trickling filters will be followed by secondary clarifiers, but sand filters do not require secondary sedimentation (Figures 1 and 2).

Bacteria Are All-Important

The treated sewage usually is removed from a trickling filter through an underdrain system, above which rock, slag, gravel or other media is placed. The primary effluent is then sprayed onto the top of the filter bed to percolate down through the media to the underdrains and out to the secondary clarifiers. If recirculation is not desired, the sewage passes through the bed once; if recirculation is required, the sewage is returned to the bed for one or more times, either before or after secondary settling.

The filters clarify and stabilize the applied sewage by aerobic biological action. The media of the beds is home to the bacteria, protozoa, and other microorganisms. The organic matter in the sewage is food; air is supplied either by dissolved oxygen in the sewage, sucked in as the sewage percolates through the bed, or by air channels from outside the bed through the underdrain system and then through the spaces between the media. In most cases air (oxygen) is available to the bacteria from all three sources.

When the bacteria are supplied with food and oxygen, they will eat up the organic matter (thus reducing the B.O.D.) provided they have sufficient time to do so. This time element is one of the reasons that maximum loadings are set up for filters. If the contact time is too short, the B.O.D. removals will decrease.

Another design and operating criteria is the amount of food that can be applied to a given filter; that is,

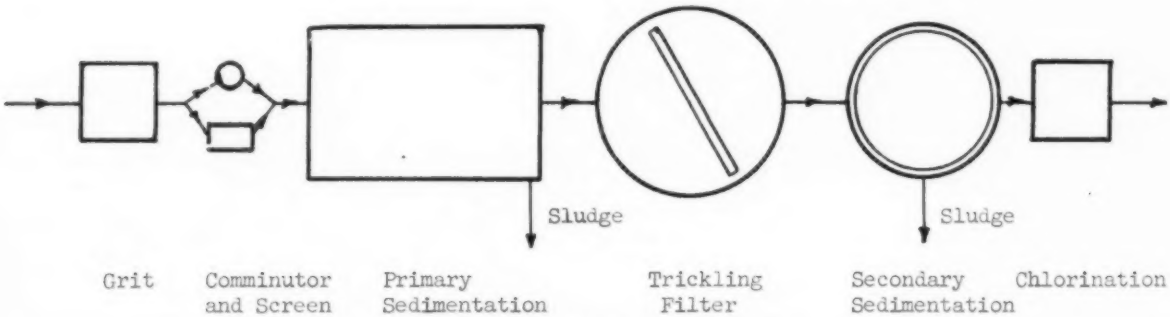


Fig. 1.—TYPICAL trickling filter flow-diagram.

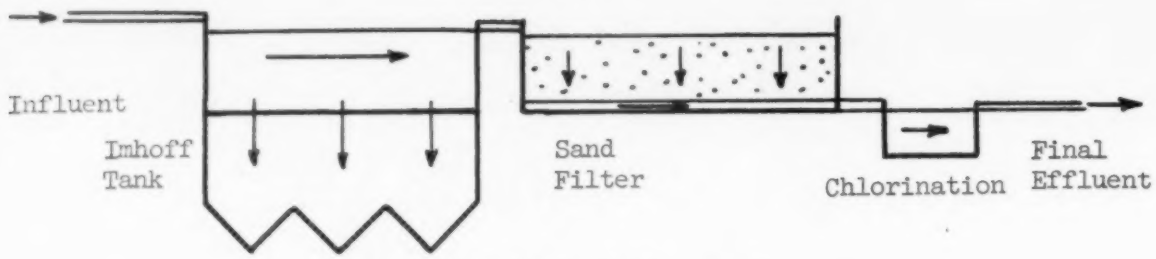


Fig. 2.—FLOW diagram for a sand filter.

the organic loading. Too much food in relation to the volume of the filter —and therefore the number of bacteria—will give the bacteria indigestion and B.O.D. removals will decrease. On the other hand, too little food (too low an organic loading) will cause some of the bacteria to die of starvation, thus reducing the filter's efficiency.

In addition to the hydraulic and organic loading criteria, the bacteria must not be fed toxic materials, work best in moderate temperatures, and like to live in a neutral pH range. As can be seen, the bacteria are somewhat fussy. Therefore, why is there so much concern about them? The answer is simple—they are the workers at the treatment plant. All the operators do is keep the bacteria happy and contented by adjusting their environment. The plant operator is really a housekeeper, the bacteria are the important members of the "household." In other words, no bacteria, no treatment—even if there were a hundred operators. This is why the term "filters" is incorrect when applied to these units. The stabilization of the sewage is obtained by biological action, not by filtration.

Conventional Filters

As previously described, and illustrated in Figure 1, a trickling filter plant consists of preliminary treatment devices, primary sedimentation, the filter, secondary sedimentation, chlorination, and sludge treatment and disposal. A high-rate filter without recirculation would be similar to this, but the rate of application would be greater and the filter bed would not be as deep. If recirculation is used, additional piping and pumps are required to return the recirculated flow to the system. Because there are many possible ways of recirculating, no one flow pattern will do. Some of these variations will be shown and discussed later.

To further complicate the picture, filters are sometimes used in series. In this procedure the settled sewage first flows through one filter and then through a second (Figure 3). Here again, many variations are possible. For example, all the sewage may be applied to the first filter and then to the second, or part of the flow put through the first, and then this part plus the remainder of the primary effluent put through the second. Another variation sometimes used in this "stage-filtration" system, is to alternate the flow pattern so that the primary effluent which was first applied to filter number one and then through

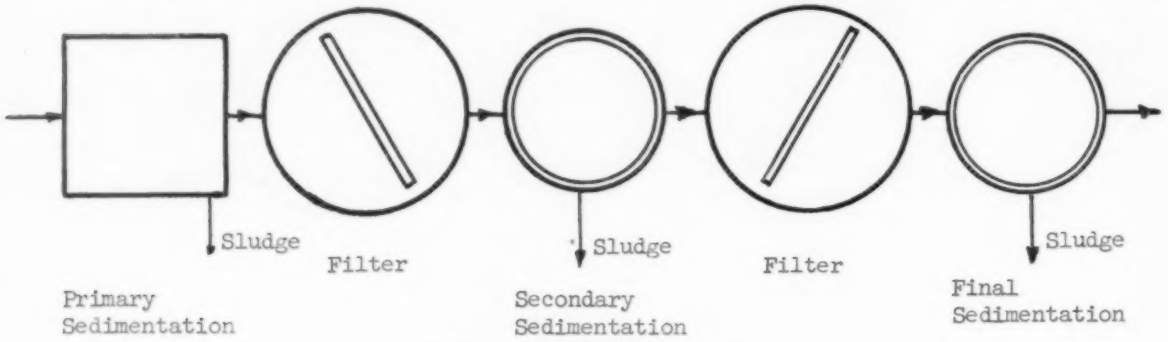


Fig. 3.—SERIES operation flow diagram.

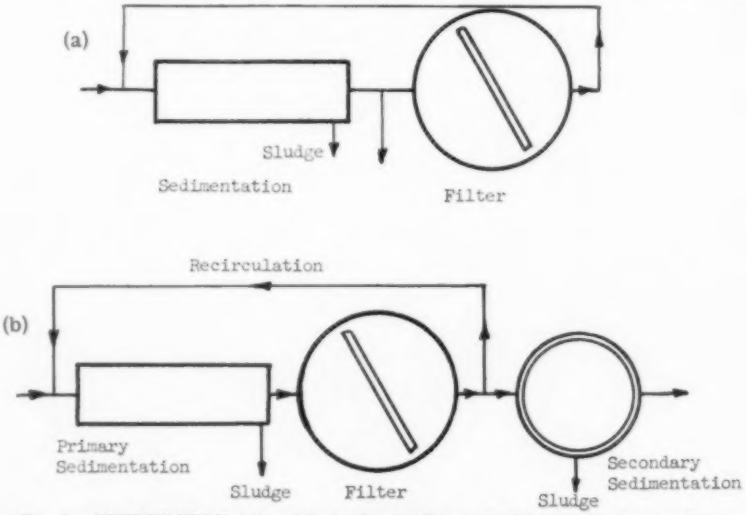


Fig. 4.—RECIRCULATION (a) with single clarifier and (b) ahead of secondary sedimentation.

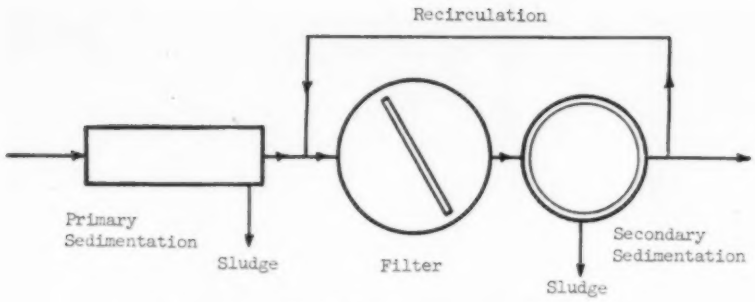


Fig. 5.—RECIRCULATION after secondary sedimentation.

number two, is applied instead to filter number two first and then back onto number one.

Low-Rate vs High-Rate Units

Whether a filter is classified as a low-rate or high-rate unit depends upon two factors—hydraulic or liquid load on the bed, and the organic or B.O.D. load. Both criteria are important for, as previously mentioned, a certain contact time and a certain food supply are both essential for efficient operation. The hydraulic loading is a measure of the contact time, and the organic load is a measure of the food.

Low-rate filters are generally those that have between 1 and 5 mgd applied per acre of filter bed. These units are usually from 6 to 10 feet deep. With good operation they will normally remove more than 85 percent of the B.O.D. of a domestic sewage.

High-rate filters usually operate in the range of 10 to 30 mgd per acre. They are usually shallower in depth, running from 3 to 6 feet deep. Because they are dosed at a higher rate, the efficiency will be lower unless recirculation is used. However, with good design and good operation, very high removals can be obtained even with the greater applied loadings.

The hydraulic loading rates mentioned assume that an average domestic sewage is applied to the filter. On that basis, the organic loading rate (B.O.D.) for a low-rate filter is 1,500 to 7,500 lb of B.O.D. per acre of bed per day; for high-rate operation, the loadings used are from 10,000 to 45,000 lb of B.O.D. per acre per day.[1]

Incidentally, the subcommittee of the Federation's Committee on Sewage and Industrial Wastes Practice has recommended an entire new set of units for all terms used in sewage works.[2] The foregoing loadings are expressed in the older units, however, so it might be good practice for the reader to convert these to the new, recommended units after reading this article.

So much for conventional trickling filters and their operation. What are some of the variations and developments in filters?

Variations and Developments

Low-rate trickling filters replaced sand filters, historically, because sewage loads—both hydraulic and organic—had increased to the point of lower and lower removals through the sand units. High-rate filters and recirculating filters followed for similar reasons. With the continually increasing demands on treatment works, operators and research workers have continued to seek ways of loading these filters with still greater quantities while retaining high degrees of removal. Most of the results of these experiments have been patented by the various equipment manufacturers and have been given trade-marked names.

Recirculation of a waste through a filter usually will assume one of two basic patterns—recirculation before clarification (Figure 4) or recirculation after clarification (Figure 5). In the first case, the filter effluent to be recirculated is returned to the primary clarifier for sedimentation, the primary effluent (recirculated flow + new waste) going back to the filter. The plant effluent may be picked off at either of two places—between the primary tank and the filter (Figure 4a); or after the secondary clarifier (Figure 4b).

Figure 5 shows the flow diagram for recirculation after secondary sedimentation. The portion to be recirculated is returned to the filter, the remainder of the flow going to chlorination and discharge. In all types of recirculation there naturally must be an effluent so that the volume on the filter does not build up indefinitely. There is one exception—in plants where the raw sewage flow drops to an extremely low amount. This often leads to recirculation of almost all (or all) of the flow so that the filter will not dry and the microbes die. In these cases, the main purpose of recirculating is to keep the filter bed wet. At other times, part of the flow may be recirculated to keep up the hydraulic load on a filter.

Stage filtration may also have many flow patterns. One typical arrangement without recirculation is shown in Figure 3. All of the stage operations are series arrangements and again the returned flow may be diverted before or after sedimentation and returned directly to the first-stage filter, or there may be no recirculation

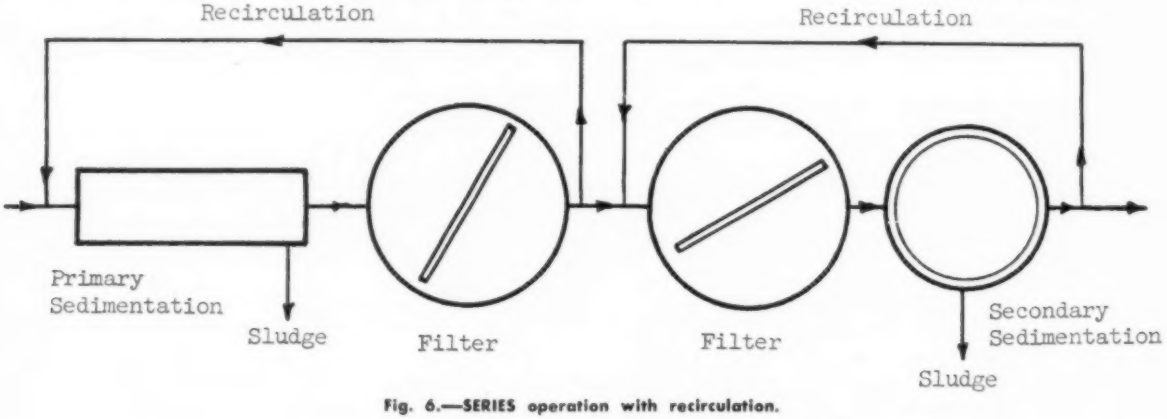


Fig. 6.—SERIES operation with recirculation.

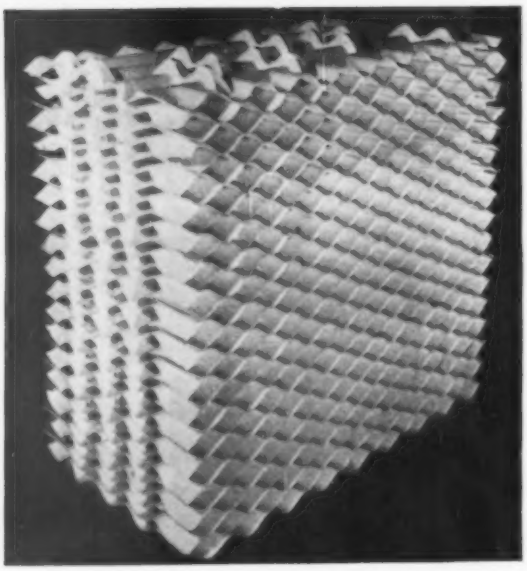


Fig. 7A.—PLASTIC filter bed media now under development.

Fig. 7B.—EXPERIMENTAL tower filter using plastic media.

(Both photos courtesy Dow Chemical Co. which is carrying on experimental development studies with this polystyrene plastic media.)

at all. Figure 6 shows one type of series operation with recirculation.

Media Suitability

Recent developments in trickling filters have been in several directions. Attempts have been made to utilize either native materials or new synthetic materials as bed media in place of the customary rock or slag. This approach seeks primarily to reduce the initial cost of filters. Experiments have been under way at the University of Florida for some time to determine the efficiency, suitability, and durability of native Florida materials as filter bed media. A bed of slag was the control against which river gravel, waste pine wood, and limestone were compared. The results of these tests showed that these native materials, costing much less than the conventional slag media, made acceptable substitutes. Another interesting result of these experiments was the observation that good B.O.D. removals had been obtained at both the 2-foot and 4-foot depths, and after further study Furman advocated 4-foot filters for semi-tropical areas.[3,4,5]

Use of an artificial or synthetic media for a trickling filter has been reported by Bryan.[6] This is a plastic material (polystyrene) which is presently fabricated in corrugated sheets and other forms. It has been reported[6] that the biological slimes will attach themselves to the plastic sheets. Several advantages are claimed for this material compared to conventional media—light weight, high void space ratio, ventilation, and ease of assembly and packing of the filter. Experimental units using this material have generally been in the form of a tower, rather than in the familiar circular shape of the slag or rock filters (Figure 7).

Other Developments

Another direction in which recent research has turned is toward other biological mechanisms or devices. In Germany,[7] designers favor deep filters (10 to 12 feet) in preference to recirculation. To provide adequate ventilation through the filters, the bed has a false bottom below which the outlet and aeration holes are provided. It is claimed that, without recirculation, this filter can reduce the applied

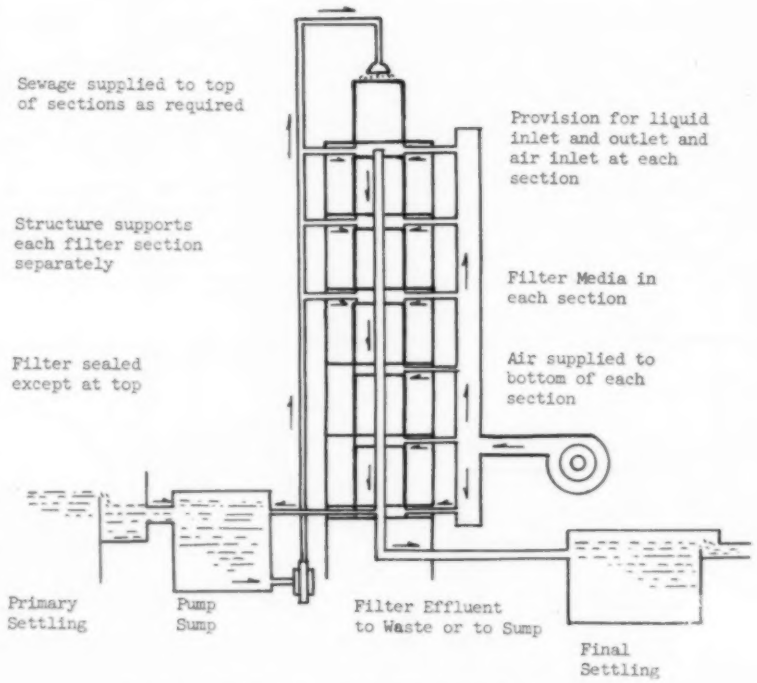

Sewage supplied to top of sections as required
Structure supports each filter section separately
Filter sealed except at top
Provision for liquid inlet and outlet and air inlet at each section
Filter Media in each section
Air supplied to bottom of each section
Primary Settling
Pump Sump
Filter Effluent to Waste or to Sump
Final Settling

Fig. 8.—DIAGRAM of controlled filtration (after Ingram).

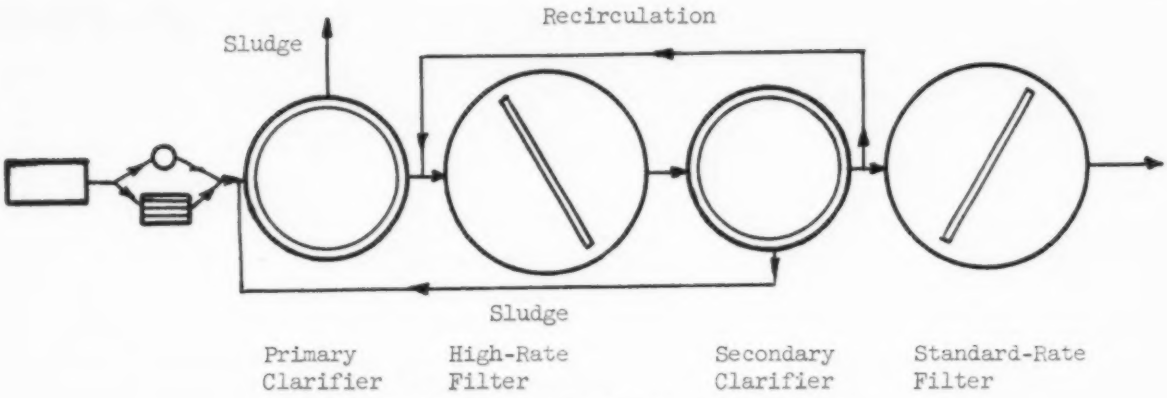


Fig. 9.—HIGH-RATE recirculation followed by standard-rate filter.

B.O.D. of 157 ppm to 14 ppm; a reduction of 91 per cent.

Several investigators have operated tray-type percolating filters arranged as a tower. These consist usually of a series of trays or cells, one above the other, with air spaces between. The sewage is applied at the top and flows down, picking up oxygen as it drops from the higher to the lower tray. Gloyna and Smith[8] reported a 90 percent B.O.D. reduction after settling. Bernhart[9] reported on using pre-cast concrete cells in tiers.

To improve the efficiency (using high loadings) these tower arrangements have also been investigated using forced air. Schulz[10] reports using an experimental tower filter with forced ventilation and without artificial aeration. When natural ventilation was used, he obtained a 91 percent reduction in B.O.D. at about 4.5 times the normal loading.

Another experimental unit of this type is that reported by Ingram[11] and shown in Figure 8. This also employed artificial aeration and he concluded that: "A standard-rate filter which would effect the same amount of removal would require 24 times the area and contain 8 times the media volume. A high-rate filter would require 14 times the area and 4 times the volume".[12] During the course of these studies it seemed that "no reliable limiting relation or removal of B.O.D. to either organic or hydraulic load was found".[12]

This unit (Figure 8) was sealed except at the top. After settling, the sewage was pumped to the top of each of the six sections of the tower. The sewage flowed down through the filter stone in each section to the final settling tank. Air was forced into the bottom of each section. Part of the sectional effluent could be returned to the primary effluent pump sump. For part of this study, all the sewage was applied to the top of the tower; for other study phases, sewage was applied to the sections.

Where sewages having high B.O.D. have been encountered, as in industrial wastes, or where high quality effluents are required for a domestic sewage for only part of a year (for example, summer time with low stream flows, or for recreational purposes), trickling filters have been used in series with other types of secondary treatment. Various schemes have been utilized — standard-rate filters followed by sand filters or activated sludge; standard-rate filters followed by high-rate filters, etc. Sometimes it is more feasible to build the first unit now, and add on the second when the community grows, more financing is available, or for other reasons. Figures 9 and 10 show two of these arrangements currently operating in Alabama. In these series operations, the first filter may serve several purposes—it may take up shock loads which would make the activated sludge operation difficult, or it may iron out the effects of an industrial waste discharged at intervals. At any rate, simpler operation, higher loadings, smaller plants, and better removals are usually the objectives of these systems.

The next article in this series will be concerned with the effects of industrial wastes on sewage plant opera-

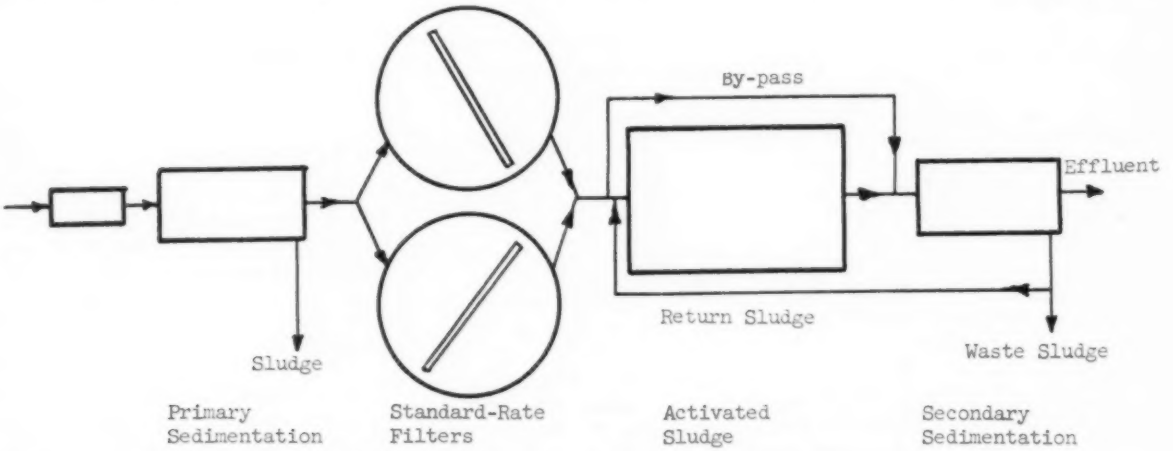


Fig. 10.—STANDARD-RATE filters followed by activated sludge.

tion. Many excellent suggestions have been reported by operators who have had these problems and all operators may well benefit by these solutions to exasperating situations.

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12. *Ibid*, p. 24.

Fred Maurer Promoted to Associate Editor of *Water & Sewage Works*

The Scranton Publishing Co., Inc., is pleased to announce that Fred C. Maurer was promoted from Assistant Editor to Associate Editor on January 1st. In this capacity Fred will be reporting more conventions and doing more production editing than heretofore.

Prior to his present promotion, Fred Maurer, has been Assistant Editor of WATER & SEWAGE WORKS, since 1951, and Assistant Editor of INDUSTRIAL WASTES since its inception in 1955.

Before joining *Water & Sewage Works*, in 1950, Mr. Maurer, was employed by the Public Relations Firm of John D. Whitmore, handling one of the principal accounts, The Woburn Chemical Corp. During this period, he wrote technical articles for *Chemical Engineering, American Paint Journal, India Rubber World*, and other journals covering application of the company's basic chemicals in these fields. He also prepared a complete series of Technical Bulletins on the company's products, and directed a Voice of America broadcast based on the company's chemical plant as being typical of the chemical industry in the United States.

Mr. Maurer spent four years in the United States Army Signal Corps., during which time, part of his tour of duty included duty as a communications instructor. He currently holds the rank of Captain in the Retired Reserve and he is a member of AWWA and NYSIWA.

J. W. Wakefield to Head Florida Water Agency

John W. Wakefield, formerly head of the sewage and industrial wastes division of the Florida State Board of Health at Jacksonville, has been appointed director of the newly created Department of Water Resources.

He will be headquartered in Tallahassee, where the state organization was set up by the 1957 legislature to study and exercise control over water supplies in the state.

H. Ludwig and J. Feeney Form Engineering Firm

Harvey F. Ludwig and Joseph L. Feeney, have announced the formation of Ludwig Engineering with offices at 490 East Walnut Street, Pasadena, California.

CORRECTION

To Page 518 of Nov. 1957 Issue

Mr. Anthony Sparr, of Nassau County, N. Y., has called to our attention an error in the caption appearing under the photograph on page 518 of the November 1957 issue.

The caption which appears under the photograph on page 518 should have appeared under the picture on page 517. The caption for the photograph on page 518 should have been "Pneumatic hoist utilizing small rotary blower for air supply."

We apologize to the author and to the Chicago Pump Co., whose Swing Diffusers are hoisted by this device.

Nelson Nemerow Goes to Syracuse University

Dr. Nelson Nemerow has accepted a new position as Professor of Civil Engineering at Syracuse University in Syracuse, where he will teach and do research in Sanitary Engineering effective Feb. 1, 1958.

Dr. Nemerow has served in the capacity of Assoc. Prof. of Civ. Eng. at North Carolina State College in Raleigh, N. C. He is currently Chairman of the Research Committee of the San. Eng. Div. of ASCE and an active member of the Federation. An author of some 40 technical papers, he has specialized in the field of industrial waste treatment.

Pa. Water Works Operators Tour New Kensington Plant

The New Kensington Municipal Water Authority, during a recent meeting of the western regional Pennsylvania Water Works Operators Assn., was host at an all-day tour of the Valley Camp pump station and the purification plant which is nearing completion.

The tour, under the direction of Steve Davis, manager of the Authority, pointed out that New Kensington has had more of an acid and mine waste problem than probably any other water plant on the Allegheny river.

Research studies on radioactive sludge undergoing anareobic digestion show the usefulness of . . .

Redox Potentials *in sludge digestion*

By W. N. GRUNE and T. H. LOTZE, respectively Associate Professor, School of Civil Engineering, Georgia Institute of Technology, Atlanta, Ga., and Research Project Engineer, Fischer & Porter Co., Hatboro, Pa.

EDITOR'S NOTE: This article* presents the results of research on two laboratory sludge digesters, equipped with redox potential cells. One digester contained radioactive phosphorus; the other was a control. The authors conclude "that an excellent correlation between ORP and digestion progress can be obtained," and they believe "that ORP and pH measurements will offer a convenient and valuable means to improve the economical operation of sludge digesters." A novel type of non-plugging and non-polarizing flow cell for measurement of redox potential is described.

■ THE ULTIMATE OBJECTIVE of sludge digestion is the reduction of large and complex molecules into simpler and more stable products, to render a readily driable sludge, to return the supernatant for further biological treatment, and to gasify the volatile solids. This is accomplished by inducing putrefactive decomposition under controlled conditions.

Additional advantages resulting from sludge digestion are the production of gas, high in calorific value (Net fuel value: 520-670 Btu per cu ft @ 60°F. and 30 in. Hg, measured wet), and the dried sludge which has found wide application as a soil conditioner and fertilizer. From recent research a process has been developed for the extraction of economical quantities of Vitamin B for use in livestock supplements.

A batch digestion process, conducted anaerobically, normally passes through three distinguishable stages of bacterial decomposition. Attendant with the decomposition is increased reducing activity typical of bacterial metabolism and decompositions.

The first stage of digestion, the *acid fermentation stage*, is characterized by some putrefactive odors (H_2S), and pH decreasing to 5 or lower. The materials destroyed are the more easily attacked carbohydrates such as sugars, starches and celluloses. The bacteria involved manufacture quite specialized enzymes which catalyze the breakdown of the carbohydrates into organic acids, acid carbonates, large amounts of carbon dioxide and small amounts of hydrogen sulfide. The more active respiratory enzymes active during this process are: dehydrogenases, phosphorylases and oxidases.

After about two weeks at a temperature of 60 degrees F., the acid production ceases and a slow rise in pH is noted, lasting possibly three or four weeks. This period, the *acid regression stage*, is characterized by the evolution of increasing amounts of methane and decreasing amounts of carbon dioxide as well as a pH rising to 6.5 or 6.8. A different group of bacteria manufactures enzymes

$$E_h = E_o + \frac{0.06}{n} \log \frac{[\text{Oxid.}]}{[\text{Red.}]}$$

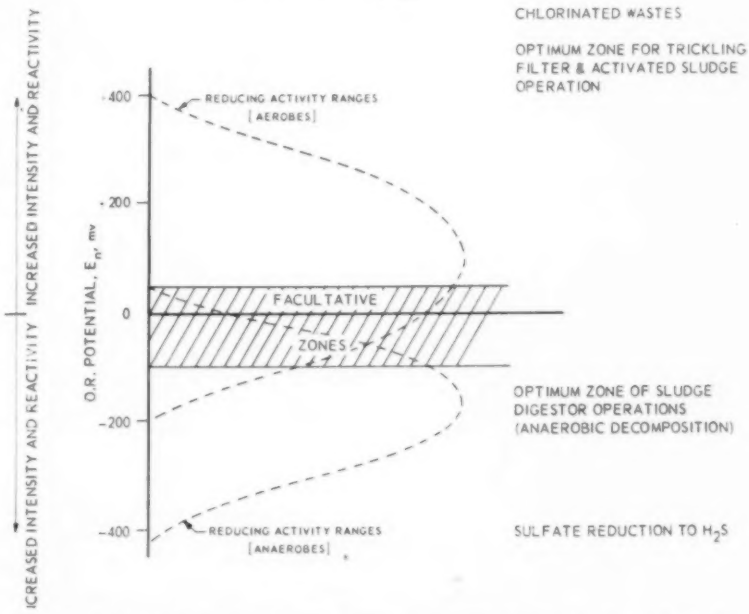

Fig. 1—BACTERIA classified as aerobic are most active when the ORP is between +400 and —200 mv. Anaerobic bacteria function best between ORP values of +50 and —400 mv. Facultative anaerobes can function in both ranges but find enhanced activity in the negative potential range. (Note: The abscissa should be E_h mv not E_o, mv.)

*Presented at the Laboratory Analytical Instrumentation Symposium, Southwide Chemical Conference; released for publication in *Wat. & Sew. Wks.*

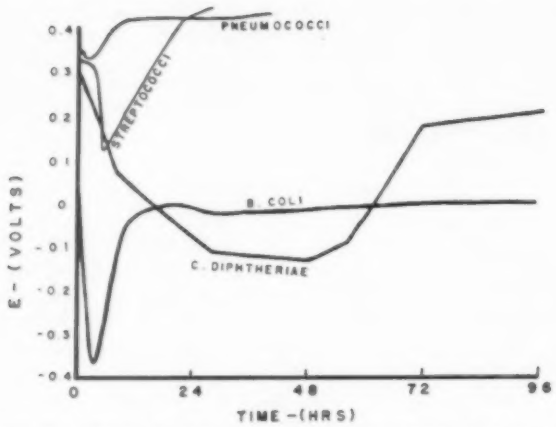

Fig. 2—ACTIVE GROWTH of bacteria is not initiated until a discrete value of ORP is attained as these examples show.

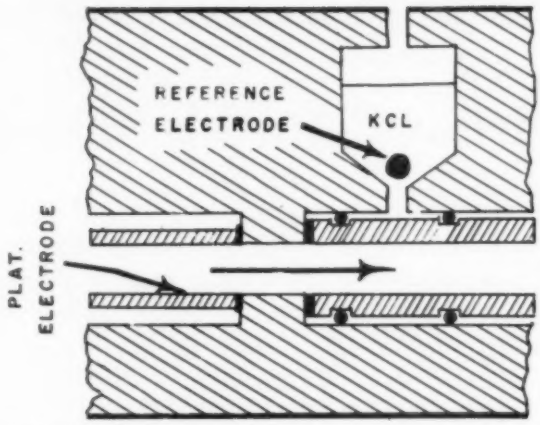

Fig. 3—UNIQUE FLOW CELL presents no obstruction to flow and no possible plugging by fibrous materials in the sludge.

(deamination) to catalyze the decomposition of organic acids and nitrogen-bearing compounds into acid carbonates, ammonia compounds, carbon dioxide, methane, and a small amount of hydrogen. Odors predominant through this stage are due to indole, skatole, mercaptans and hydrogen sulfide which become weaker as the end of this stage approaches.

The third or *alkaline fermentation stage*, is heralded by an accelerated rise in pH and increasing evolution of gas containing 60 per cent or more of methane. The pH continues to rise as the more resistant organic acids, proteins and celluloses are decomposed by the action of a different regime of bacterial enzymes. The gas is composed chiefly of methane with decreasing fractions of carbon dioxide. Odor formation is negligible and the pH may rise to 7.5 or higher.

The Role of ORP

Measurements of the redox potential of the sludge as digestion proceeds would show a potential falling steadily from about +50 mv to —300 or —400 mv for complete digestion, indicating the presence of strong reducing conditions. This is quite characteristic of bacterial action. In fact,

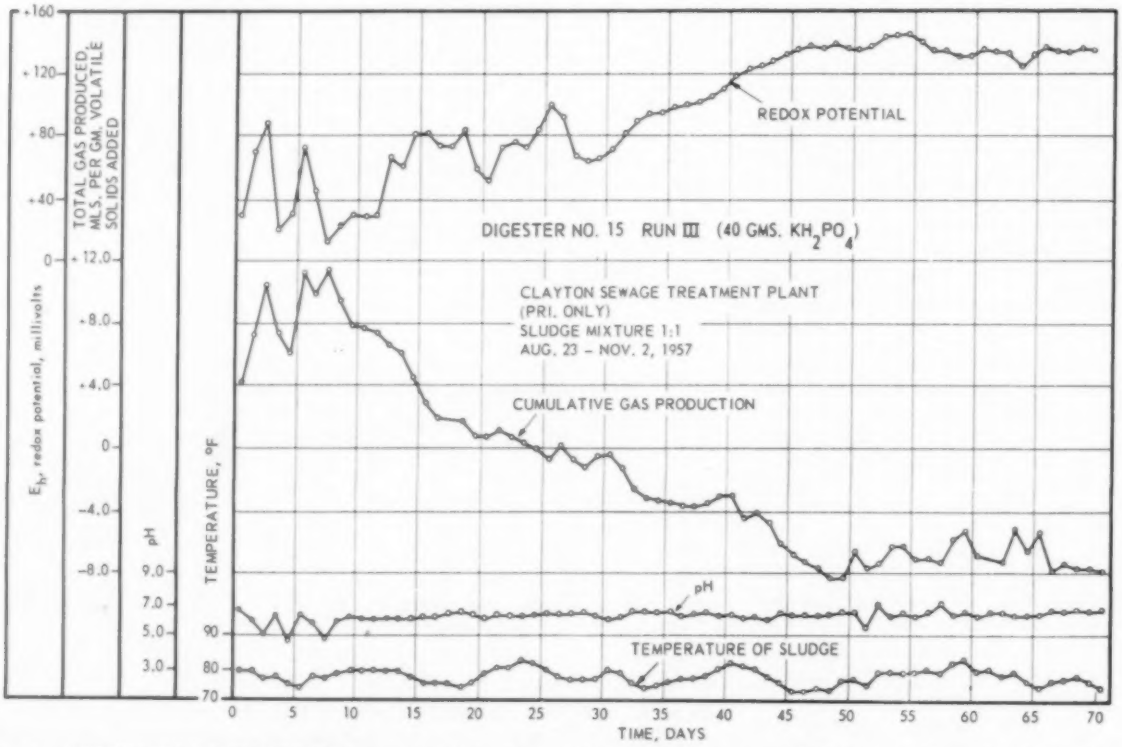

Fig. 4—INTEGRATED DAILY READINGS on gas production, and weighted averages of 24 hr recordings of redox potentials of digesting sludge containing stable isotope KH_2PO_4 show relation between digestion course and oxidation-reduction potential. (Note: Dates of run were Aug. 23-Nov. 2, 1956, not 1957.)

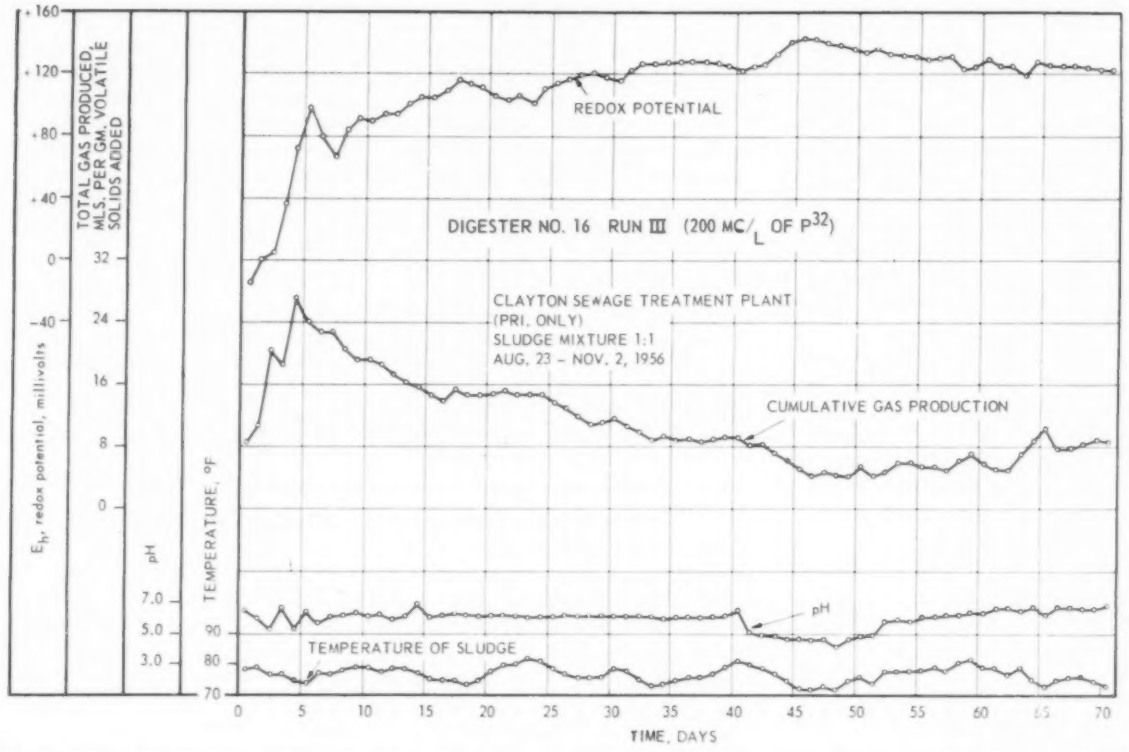

Fig. 5—RELATION of redox potential and cumulative gas production in digesting sludge containing 200 MC/L of radioactive phosphorus is also evident although the cumulative gas production shows some difference from the control sludge. (Fig. 4.)

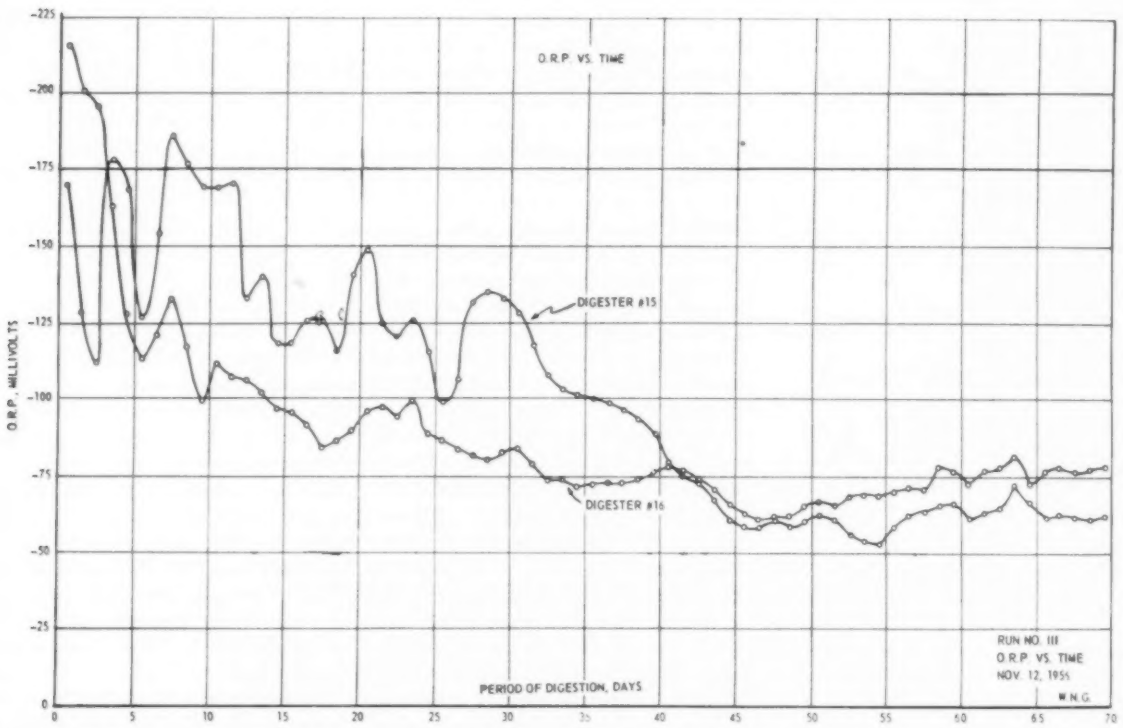

Fig. 6—TRENDS in redox potential are reproducible as indicated by this plot of ORP vs time for the two digesters, but additional confirmatory data is to be sought.

Author's Comments

The past several decades have seen intensive research into the mechanisms underlying sewage treatment techniques. Evolution of the activated sludge process represented one of the major advances in the field with evidence to indicate that further modifications may substantially increase the capacity of existing systems.

Attendant with the improved performance in sewage treatment is the increased demand for more adequate analytical and control techniques. Hood[1] and Eckenfelder,[2] among others, have described analytical techniques which effectively reduce the time formerly required to estimate biological and biochemical process efficiencies. The advantages to the sewage treatment plant operator for correcting poor operation and improving efficiency are obvious.

With the constant increase in the use and application of radioisotopes and the advent of commercial power reactors, further problems have been presented to the treatment plant operator. Information as to the influences and problems accompanying economical treatment of radioactive wastes and their ultimate disposal is still far from complete. The National Science Foundation is supporting a comprehensive research program to investigate the possibilities of biological radioactive waste treatment under anaerobic conditions. This paper covers a narrow portion of the complete program as is being carried out at the Sanitary Engineering Research Laboratory, School of Civil Engineering, Georgia Institute of Technology.

classification of bacteria may be accomplished by measuring the activity level of the bacteria as a function of the redox potential. It can be seen in Fig. 1 that those bacteria classified as aerobic are most active when the redox potential is between +400 mv and —200 mv. The anaerobic bacteria function best between ORP values of +50 mv and —400 mv. Facultative anaerobes can function in both ranges but find enhanced activity in the negative potential range.

Examples of this method of classification are shown in Fig. 2 where active growth of bacteria is not initiated until a discrete value of ORP is attained. Intense reducing activity is then evident as a result of the logarithmic growth phase of the bacteria and the ORP falls to a minimum. At this point, the food supply is exhausted and bacterial death rate overtakes the growth rate and lysis or stasis prevails. This point appears to be characterized in some cases by a rising O-R potential. It has been suggested that this rise in ORP is due to peroxide formation and a failure in catalase activity. It should be pointed out that oxygen was available to the systems shown in Fig. 2, thus making peroxide formation possible.

Laboratory Procedure

Two digesters were charged with 700 ml each of a mixture of raw and well digested sludges obtained from a local treatment plant. To one of these digesters (No. 15), 40 grams of stable isotope potassium acid phosphate were added as a control. To Digester No. 16, 140 millicuries, in the form of radioactive potassium acid phosphate (P^{32}), were added to produce a concentration of 200 millicuries per liter. Both digesters were maintained at an average temperature of 75 degrees F. Air was excluded, and readings of gas production were taken daily with a gasometer of the type illustrated by Imhoff and Fair,[3] and corrected to S.T.P. The sludge was agitated by recirculation through the ORP cells (Fig. 3) with a hose pump described by Okun.[4] Temperature and pH were also recorded as shown in Fig. 4 and 5.

The points from which the curves of Fig. 4 and 5 were plotted are taken from the integrated daily readings of gas production and weighted averages of 24 hours recordings of redox potential. The ORP values are corrected for the potential of the normal Hydrogen electrode, i.e. E_h.

Results

The remarkable parallelism between the redox potentials recorded for the two digesters, shown in Fig. 6, is more than mere coincidence since each point represents a 24-hour integrated and weighted average from a continuous chart recording. This graph assumes greater significance when it is realized that the substrate is a heterogeneous mass and that sampling errors exist between individual digesters. If to this the inherent errors in measuring and recording systems is added, the point is strengthened.

The correlation between ORP and cumulative gas production is obvious from Fig. 4 and 5, especially from Fig. 4. Two conclusions which may be drawn and appear to be reasonable are: (1) the trends in redox potential are reproducible (from Fig. 6).

Note: These potential values are not corrected to obtain E_h; to do so add 197 mv to obtain values shown in Fig. 4 and 5.

(2) The redox potential is correlatable with the cumulative gas production for either digester. It remains to increase the available data to confirm these conclusions.

During the digestion period, both digesters appeared to be buffered at a value of pH 6, indicating that the ability of the sludge to digest and to proceed to the alkaline fermentation stage was definitely impaired. Reversals in ORP during early stages of the digestion suggest the bacterial activity similar to that pictured in Fig. 2. Less pronounced reversals in the radioactive sludge indicate the possibility of reduced or static growth rates and hence less bacterial activity. Further work is being done at different pH levels to determine whether or not the buffering action of the acid phosphate salt was the only factor preventing progression to the alkaline fermentation stage.

Redox Potential Cell

The design of the flow cell, as shown in Fig. 3, is unique. It presents no obstruction to flow or possible plugging by fibrous materials in the sludge. The large area platinum electrode in combination with rapid flow effectively reduces the possibility of solution polarization. The silver-silver chloride electrode was chosen for its simplicity for replacements and its ruggedness.

The platinum electrode was prepared by cladding 0.007 inch platinum inside a solid brass tube and making the electrical connections to the brass.

The silver-silver chloride reference electrode was prepared by making a fine silver rod the anode in 10 per cent HCl and 10 per cent NaCl solution and plating for several hours at a low current density until a heavy adherent coating of blue-brown silver chloride was formed.

The flowing liquid-junction is formed through the porous porcelain tube with saturated potassium chloride solution. A pressure of 2 to 5 psi greater than the static pressure of the flowing sample is applied to the KCl reservoir. The resultant flow of KCl prevents deposition of solids on the porcelain tube and diffusion of the sample into the reference electrode.

The assembly of component parts was mounted in an Uscolite block and electrical connections were made to an industrial potentiometer recorder. Cleaning of the cell is easily accomplished by several passages of a test tube brush.

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1956 Waterborne Disease Outbreaks

Dr. Dauer, medical adviser to the chief, Public Health Service, and Mr. Sylvester, analytical statistician with the Morbidity Analysis Section of the National Office of Vital Statistics, Public Health Service, in their recent report on the 1956 Summary of disease outbreaks, stated that there was an increase in the number of waterborne disease outbreaks in 1956 compared with those of the past several years. In 1955, there were only two outbreaks with an unknown number of cases, probably less than 50. However, in 1956, there were 9 waterborne outbreaks of disease in which 1,719 persons were affected.

The 1956 outbreaks represent 2 rather large and 2 small outbreaks among persons who drank water from contaminated public systems. One outbreak involving about 800 persons was classified as shigellosis. Shigella flexneri was isolated from stool specimens from several of the patients. The specific organism was not found in the water, but an organism resembling shigella was isolated. There was substantial evidence that the city supply had been contaminated with raw water from a mountain stream. Evidence of fecal contamination was found along the stream, probably deposited there by campers known to have used the area. In another outbreak, about 700 persons in a small town become ill after the public water supply became heavily contaminated with surface drainage following a sudden rain storm. A third outbreak occurred in one section of a city. Here, the supply was contaminated by raw water from a stream being forced into the public water system by a sprinkler system pump of a resident living in the area of contamination. The fourth outbreak was traced to contamination of the water system during repair of a city main. When a ditch was opened about the main it filled with water from seepage, necessitating continuous pumping while the repair was being done. Although the line was flushed upon completion of the work, no sterilizing agent was used.

Three other outbreaks of gastroenteritis occurred in camps where untreated water was being used. In one camp, the local water company pumped raw creek water into the system because a well, orinarily used as a source of supply, produced insufficient water during periods of peak demand. The remaining outbreaks were in two separate families whose water supply was private. In one family, Salmonella typhimurium was isolated from stool specimens, and the water in an old dug well was found to be contaminated. The outbreak in the other family resulted from poison being dumped into a well.

Three other disease outbreaks were reported in which water was suspected, but definite evidence was lacking. One was hepatitis (number of cases unknown) in a school. Another was among social workers at a gathering held in a place where new water pipes had been installed. It was reported that the pipes had not been flushed when the system was placed in operation. The third occurred in persons attending a church camp and is described under typhoid fever.

Hazen-Williams Hydraulic Slide Rules Available

Roger I. Eby, San Francisco, California, has in stock a number of Hazen-Williams Hydraulic Slide Rules.

The slide rules are available for $15.00 each, postpaid to points within the United States. Orders should be sent to: Roger I. Eby, 1014 Merchants Exchange Bldg., San Francisco 4, California.

Water Bill Envelope Stuffer

Starting back some 20 years, the Ford Meter Box Co., prepared a little 1-color envelope stuffer entitled, "How Would You Like to be Without It"?, which the company offered to water utilities at cost. According to the reports this stuffer was so well received by water works men that over a million copies were supplied to different water works from Main to Honolulu.

A few years later a second stuffer was prepared and was equally well received. In fact, the second stuffer was copied in the New Yorker magazine.

Now after a period of 15 years, the company has produced a third piece. The new stuffer is an attractive, 4-color stuffer with David Ford's poem on "Just Add Water."

The company is offering this third stuffer, on the same no-profit basis, to water works. It is available in a variety of forms, sheet or trimmed, blank or imprinted. Samples and costs can be obtained from the Ford Meter Box Company, Inc., Wabash, Indiana.

In this Part 2 of the report on the 30th annual meeting in Boston in October, the late Linn Enslow's notes disclose information on . . .

P. L. 660 and Uniform Design Standards

Ed. Note: In the previous issue, *Water & Sewage Works* carried Part 1 of this report. Part 2 was to have been written by our late editor for this issue, but his sudden passing in early November left the report unwritten. However, we do have his notes taken at that meeting and publish them here as his last meeting report. Although he attended two other meetings before his death, no notes have been found on either.

■ THE EVALUATION of the program and construction grants for sewage treatment under the Federal Water Pollution Control Act, Public Law 660 constituted the topic of one "sewage works panel". This was the third annual panel on the subject and was moderated by Milton P. Adams, Exec. Secy., Michigan Water Resources Commission. Participating were four representatives of state government: B. A. Poole, Indiana; Paul R. Bonderson, California; A. F. Dappert, New York; and David B. Lee, Florida; one representative of Inter-State Commissions, Joseph C. Knox of New England; one representative of the Federal Government, Gordon E. McCallum of the U. S. PHS, and one consulting engineer, Frank L. Flood of Metcalf and Eddy, Boston.

MR. POOLE reported on the results of a survey questionnaire sent to all state sanitary engineers in February 1957. Information sought was the number of municipal sewage treatment plants and estimated costs for each of the years 1957, '58 and '59. The survey was divided into two groups, above and below 125,000 population. It was hoped that the results would not only give some idea of the expected construction but also give some insight as to the adequacy of the $50 million per year of federal grant authorization.

Replies were received from 40 states. In the western and east-central states the reported projects would have required more than two times the amount of Federal grants available, whereas the south-southeastern states estimated needs about one and one-third times the amount available. Some states could use four times the amount of grant monies available, while others would require only one-fourth the monies allotted.

Mr. Poole suggested that these changes in the federal program seemed worthy of study: Give consideration to adequate federal loan program for municipal sewage plants at interest rates comparable to those of 1953-56 in lieu of federal grants; or change P.L. 660 by introducing a "readiness to go" factor into the method of computing allotments to states; and increase the total federal appropriation for grants-in-aid.

DAVID LEE expressed the opinion that the FSIWA and the States must settle on the fundamentals in waste treatment and how they are to be obtained. In Florida there are no large projects; eleven have been projected and only one started. Of 118 projects in the southeast, only nine have been completed and only 16 are ready to go. Mr. Lee advocates a ten-year program.

PAUL BONDERSON reported that decisive and prompt action helped the program in California. The state passed a grant program of its own but this was vetoed by the governor. A total of $8.3 million aid was required for 81 projects. To date the grants had only sped up the minor projects, but better results are expected in 1958. Only 21 projects were actually certified in 1957 and 31 others will reapply in 1958.

Mr. Bonderson said that evaluating priority is very difficult and he was critical of the method of evaluation. While he believes that the overall grant program is helpful he thinks that the program is weak in its grants for research, a point which is disappointing to him.

A. F. DAPPERT said that in New York state there were 37 applicants, of which 24 were given priority for a total expenditure of $13-34 million. The grants fell $60,000 short. Forty-four per cent of the allotments were to small cities of less than 5000 population. Mr. Dappert said there were no complaints from the applicants and that in his opinion the grants had been helpful in speeding up projects. He hopes the program will be continued but believes more money should be available and he also believes that sewer systems should be eligible for grants-in-aid.

JOSEPH C. KNOX said he thought the funds for research were most valuable, but that construction grants are a deterrent in some states. Maine and Vermont voted grant funds to supplement the federal aid, while New Hampshire guarantees sewage construction bonds. Mr. Knox said that New England objected to the construction grants and favored a discontinuance of such grants. He believes that state and interstate authorities should devise a more adequate grant law.

GORDON MCCALLUM called attention to the development of stream stations for sampling in cooperation with the states. He pointed out that the Public Health Service was attempting to develop data to show the economic advantage of sewage and waste treatment. Mr. McCallum also

spoke about the water quality management project on the Arkansas River, the work of the Advisory Board, research grants and public reaction. He pointed out that water quality is important to industry and the location of industry in any area.

Uniform Design Standards

Under the moderator's gavel of George Martin of Green Bay, the subject of "Uniform State and Interstate Standards for the Design of Sewage Works" was presented as a panel discussion. Participating were Earl Devendorf (Mr. Dappert spoke for him) John W. Townsend, and Frank H. Miller.

MR. TOWNSEND, Cons. Eng. of Chicago, said that the Ten-State Standards of the Upper Mississippi River and Great Lakes Drainage Basins are now used almost universally in a great part if not in their entirety. He believes these standards should be reviewed at least bi-annually because of the introduction of new processes and new equipment. He also believes that the joint manual of ASCE and FSIWA will serve as an excellent guide.

FRANK MILLER, a former state sanitary engineer and now Chief Engr. of the Hampton Roads San. Dist. in Norfolk, Va., warned of the danger of over standardization. He pointed out that regulatory agencies should set safe limits but that design should be the work of the engineer. There can be guides but he does not believe in standards as such. The guide must be the result of qualified experience and he recommended voluntary service on committees in place of federal aid for committee work. He also believes that the owner's recommendation to the designer is highly important.

A. F. DAPPERT gave some of the reasons for the somewhat rigid standards and explained the basis of the ten-state standards as being a need for greater uniformity among the states. These standards cover the common problems met by the inexperienced engineer. In New York State, the manual is well accepted; it is up for revision this year.

Operators' Forum

As usual the Operators' Forum was well attended, more than 200 persons being present. Five different topics were presented and discussed: Grit Chambers and Primary Settling, Sludge Digestion, Activated Sludge, Trickling Filters, and Oxidation Ponds.

The forum was organized and conducted by Dr. W. D. Hatfield, of Decatur, Ill., the incoming Vice President of the Federation. Each topic was introduced by a short commentary by each of two experts in the field and then opened for floor discussion.

(*Ed. Note:* Mr. Enslow' notes are rather brief and cryptic on this session and no attempt will be made here to credit the different statements to the persons making them.)

Aerated *grit chambers* seem to be favored and the use of the Hapman conveyor for grit handling shows considerable promise. Velocity through aerated grit chambers is better than in unaerated one. In one plant a Hydro-crane is used to remove grit from the chamber.

In *sludge digestion*, temperature control is very important. New tanks should be started up slowly. There is considerable confusion in expressing digestion tank loadings. About 50 per cent of a digestion tank capacity is for storage, only about 37½ per cent is actual digestion capacity. High rate digestion has many advantages and is more economical than the older methods.

In *activated sludge* treatment, the important factors are loading, aeration, and return sludge per cent of mixed liquor flow. It is better to use high per cent of return than to allow sludge to become septic. The final tanks are just as important to the process as the aeration units. Operation on the sludge age principle is effective at New York City. No real standards of operation have been developed for the activated sludge process since it was introduced 40 years ago. The use of ORP seems to be increasing in importance as a means of control.

Trickling filter loadings consist of two factors: B.O.D. and volume and both must be considered in the design and operation of trickling filters, whether standard or high rate. Treatability of the wastes is another factor, particularly where industrial wastes are included in the sewage. Recirculation should be on the basis of B.O.D. rather than volume. Step loading on trickling filters may be one answer.

In *stabilization ponds* there are a variety of factors which affect operation: Depth versus detention, recirculation for algae seeding and to preclude septicity and distributed input of sewage over the first ⅓ of the pond. Series ponding offers no advantage unless the first is a septic tank. Oxidation ponds, where temperature is favorable produce results comparable to complete treatment. Costs may run from $4.50 to $38.00 per capita. They are not universally applicable. In some cases they present a mosquito problem, which is best controlled by preventing weed growth. Additional studies are needed to define proper loadings, to determine the most practical depth, to determine the ratio of depth to area, to study algae in the effluent, to learn how to seal pervious bottoms, and to control odor.

B. A. Poole

A. F. Dappert

D. B. Lee

Jos. C. Knox

F. L. Flood

The editor's comments . . .

There Have Been Some Changes—

The only constant thing in this world is change, and it has been said that one must move forward or slip backward, for it is impossible to stand still. With this thought in mind *Water & Sewage Works* planned a number of changes to take effect with this number.

In the appearance of the magazine there have been several changes, in typography, format and features. If you have not already observed these changes, we invite you to leaf through the magazine from cover to cover and note the changes in location of certain features, the addition of others, new type styles and other new approaches to editorial make-up. The purpose of these changes is to improve the readability and usefulness of Water & Sewage Works to you, the reader.

Other changes at *Water & Sewage Works* are a new office and a new telephone number. Our editorial office is now located in Room 204 at 155 E. 44th Street in New York City (instead of Room 710)—No change in address, just a change in offices. Our new telephone number is Murray Hill 2-8326.

Regarding personnel, we had planned for several months to advance Fred Maurer to the position of Associate Editor. One change, not contemplated was the untimely loss of our Editor, Linn H. Enslow. The writer has now assumed the duties of Editor of *Water & Sewage Works*, in addition to those of Editorial Director of the Scranton Publishing Co., Inc.

We have planned other changes in magazine format and features to take place in the coming year. The purpose of these changes will be to continue to improve the usefulness of the magazine to the reader. One thing we will not change—our adherence to the ABP Code of Ethics and particularly, "to consider, first, the interests of the subscriber."

In this, we feel that we shall continue in the same path, set by Linn Enslow during his 26 years as Editor —to make this the best possible magazine in its field. We are sorry that Linn is not here to see these changes.

Like Janus—

Janus, for whom the month of January is named, was the ancient Roman (perhaps solar) diety who presided over beginnings and endings, and was generally depicted as having two faces looking in opposite directions. As such, he looked backward into the old year and forward into the new.

Like Janus, we, too, wish to look at both 1957 and 1958. For our magazine, the year 1957 showed a healthy growth in circulation and advertising. For 1958, we have high hopes that our efforts to improve both the readability and usefulness will result in the growth trend continuing upward.

For the water and sewage industry, we can look back on a year of good activity in construction. Toward the end of the year, the joint estimates of the U. S. Dept. of Commerce and Dept. of Labor indicated actual spending in 1957 would be $560 million for water works and $785 million for sewage works. These estimates indicated a decrease over 1956 expenditures of 2 per cent for water works, but an increase of 12 per cent for sewage works. The preliminary forecast for 1958 was $520 million for water works (down 7.0 per cent over 1957) and $750 million for sewage works (down 4 per cent over 1957). Some of this increase in sewage construction was due to the increased efforts resulting from the Federal P.L. 660 grants-in-aid programs; (in the first 12 months of that program, 466 cities—average 22,300 population—received nearly $40 million in grants for projects totaling nearly $167 million).

Since these preliminary forecasts, we have seen the two "niks", Sput and Mutt produce a change in thinking in Washington, with indications of cutbacks in non-defense budgets.

Although the boom has apparently leveled off in general business and construction, and although the missile program may slow other governmental programs, there is no doubt that the water and sewage industry will continue to grow. Whether or not construction efforts keep pace with demand is another matter, perhaps, but that our industry is growing and will continue to grow is very evident from consideration of these factors: The population increase in the U. S. is now at the rate of 3 million persons a year while the per capita water consumption is increasing at one gallon per year (the average in 1956 was 145 gcpd). It is evident, therefore that total water supply demand is increasing at the rate of 606 mgd each year and where that water is used, sewage must be disposed of. Thus, if there were no backlog of needed facilities (but there is) and no obsolescence (but there is) we would have to build enough water and sewage facilities each year to supply a city about ½ the size of New York. It is our opinion that the water and sewage industry will not see a decline in its activity, although it may not advance at the rate which had been expected.

While we are looking ahead, let us look at some of the prospects for this industry, based on a look back at the year just passed. In the field of water treatment, we forsee: Increased use of activated silicia in water coagulation; the introduction of "Microstraining" as a preliminary treatment to rapid sand filtration; and further interest in the use of the calcite-alum coagulation process.

In the field of sewage treatment, we may expect more cooperation between industry and municipalities on the matter of industrial waste treatment in municipal sewage works; there will be greater interest in the total oxidation process in activated sludge treatment, interest and applications for ORP will grow, as will improved grit and sludge handling and high rate digestion.

George E. Symons.

"from Chicago"

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  Control systems built to order.
- **SAFETY ALARM SETS**
  Visual and audible alarms for abnormal engine conditions.

SYNCHRO-START PRODUCTS, INC.
Since 1932
8151 N. RIDGEWAY AVE. • SKOKIE, ILL.

PHOTOVOLT pH METER MODEL 85

A Full-Fledged Line-Operated pH Meter at $105.–
including set of electrodes; available also with combination electrode at $108.–

No batteries to replace
Simple in operation
Dependable in service

Full pH range 0-14
3" scale, readable to 0.1
Available with carrying case

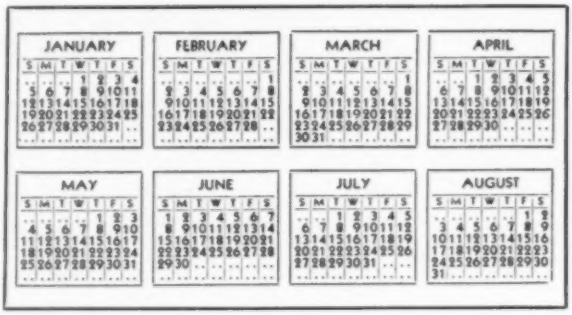
Usable with all types of electrodes, swing-arm adapter, polarization adapter for Karl Fischer titrations, electrode extension cables, etc.

Write for Bull. 195

PHOTOVOLT CORP.
95 Madison Avenue New York 16, N. Y.

Meetings

1958



Jan. 23-24—New York, N. Y. *(Hotel Belmont-Plaza)*
NEW YORK SEWAGE & INDUSTRIAL WASTES ASSN., Exec. Secy., Ralph C. Sweeney, State Dept. of Health, 55 Church St., White Plains, N. Y.

Jan. 28—New York City, N. Y. *(Park-Sheraton Hotel)*
NEW YORK SECTION, A.W.W.A., Mid-winter Luncheon Meeting, Secy., Kimball Blanchard, Ludlow Valve Mfg. Co., Inc., 11 W. 42nd St., New York 36, N. Y.

Feb. 5-7—Indianapolis, Ind. *(Sheraton-Lincoln Hotel)*
INDIANA SECTION, A.W.W.A., Secy., Chester H. Canham, 3517 Manor Court, Indianapolis 18, Ind.

Feb. 13—Newark, N. J. *(Hotel Essex House)*
NEW JERSEY SECTION, A.W.W.A., Luncheon, Secy., Albert F. Pleibel, 683 Prospect Street, Maplewood, N. J.

Feb. 24-28—Chicago, Ill. *(Hotel Sherman)*
AMERICAN SOCIETY OF CIVIL ENGINEERS, Exec. Secy., W. H. Wisely, 33 W. 39th St., New York 18, N. Y.

Mar. 2-7—College Station, Tex. *(Texas A & M College)*
TEXAS WATER & SEWAGE WORKS ASSN., Secy., V. M. Ehlers, 2202 Indian Trail, Austin 3, Tex.

Mar. 12-14—Atlantic City, N. J. *(Traymore Hotel)*
NEW JERSEY SEWAGE & INDUSTRIAL WASTES ASSN., Secy., Michael S. Kachorsky, P. O. Box 68, Manville, N. J.

Mar. 12-14—Salina, Kansas *(Lamer Hotel)*
KANSAS SECTION, A.W.W.A., Secy., Harry W. Badley, Neptune Meter Co., 119 W. Cloud St., Salina, Kan.

Mar. 20-22—Missoula, Mont. *(Florence Hotel)*
MONTANA SECTION, A.W.W.A., Secy., Arthur W. Clarkson, Asst. Director, Div. of Env. Sanitation, Montana Board of Health, Helena, Mont.
(Jointly With)
MONTANA SEWAGE & INDUSTRIAL WASTES ASSN., Secy., Harvey W. Taylor, c/o Morrison & Maierle, Inc., Helena, Mont.

Mar. 23-26—Atlanta, Ga. *(Dinkler-Plaza Hotel)*
SOUTHEASTERN SECTION, A.W.W.A., Secy., N. M. deJarnette, Engr., Div. of Water Pollution Cont., State Dept. of Health, 245 State Office Bldg., Atlanta 3, Ga.

Mar. 24-26—Fayetteville, Ark. *(University of Ark.)*
ARKANSAS WATER & SEWAGE CONFERENCE, Secy., C. W. Oxford, University of Arkansas, Fayetteville, Ark.

Mar. 26-28—Schenectady, N. Y. *(Van Curler Hotel)*
NEW YORK SECTION, A.W.W.A., Secy., Kimball Blanchard, 19 W. 50th St., New York 20, N. Y.

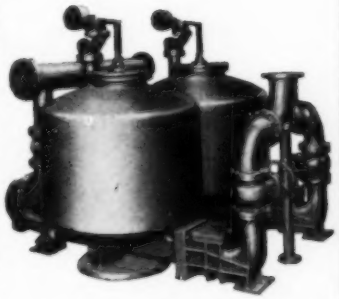
ADVERTISEMENT

for handling domestic and industrial wastes, pneumatic ejectors are better.. and..

THERE'S A YEOMANS PNEUMATIC EJECTOR SPECIALLY SUITED FOR YOUR JOB

WHY PNEUMATIC EJECTORS?

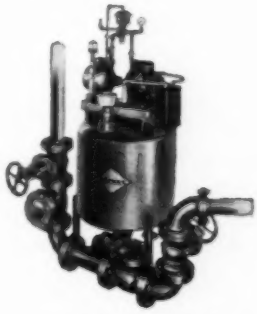
1. **Best for low gallonages.** Centrifugal pumps are efficient in larger sizes.. but for low gallonages they are inefficient. Flow is restricted.. impeller aperture is too small to pass certain solids.
2. **Completely sanitary . . odorless.** Pneumatic ejectors are fully enclosed, hermetically sealed. Liquid wastes are never exposed to atmosphere. Dangerous, asphyxiating, hydrogen sulphide gas is never released.
3. **Trouble-free.** Pneumatic ejectors have relatively few working parts which move neither fast nor far. Operation is positive. Maintenance problems are almost nonexistent.
4. **Handles solids easily.** Pneumatic ejectors will pass solids up to the size of the inlet and discharge valves.. minimum of four inches.



THE Shone®

WHY YEOMANS PNEUMATIC EJECTORS?

1. Yeomans builds ruggedly.. to outlast the system itself.
2. Yeomans builds the only complete lines of pneumatic ejectors.. more than 100 sizes in three basic types . . the Shone . . the Expelsor . . and the Packex.
3. Yeomans offers equipment in a price range for every application.
4. Yeomans *knows* pneumatic ejectors.. in fact, the first pneumatic ejector installed in America was a Shone.



THE PACKEX®

Free literature on pneumatic ejectors:
Catalog 4304 describes the electrode-controlled SHONE . . 4005, the mechanically controlled SHONE . . 4407, the EXPELSOR . . 4420, the PACKEX. Copies available on request.

YEOMANS

1999-9 N. Ruby Street, Melrose Park, Ill.

. . . manufacturers of: pneumatic sewage ejectors • centrifugal pumps • distributors • clarifiers • mechanical aerators • digesters.

Shone Ejectors Operated By Remote Compressed Air Source at Palm Beach

The problem of underground equipment maintenance was skillfully handled by the engineers of the new sewerage system at Palm Beach, Florida. The electrical equipment is housed in centrally located buildings where it is easy to service. The underground sewage lift stations contain only extremely rugged mechanical equipment which requires virtually no maintenance.

The system was engineered by Norman C. Schmid & Associates of Palm Beach and Clifford & Associates of Miami Springs. Malcolm Pirnie & Associates of New York City acted as consultants to the engineers.

Two air compressor stations at ground level furnish power for the 14 sewage lift stations at Palm Beach. Compressed air is piped to the Shone pneumatic ejectors which are located in the underground lift stations. The pneumatic ejectors operate on a mechanical principle which is practically foolproof. Need for maintenance on the valves is very rare. The Shone will even continue to operate perfectly should the entire station be submerged.

The Shone pneumatic ejector is generally recognized as the most trouble-free type of pumping known. Several, which are in operation today, have been giving good service with a minimum of maintenance for over 60 years. One famous Shone was shut into solitary confinement for 20 years. By error it was bricked up and forgotten when the building was remodeled. During the entire period it continued to give faithful service without any maintenance whatsoever.

Free Periodical On Pumping and Sewage Treatment

The Yeomans Guard is a useful publication concerned with pumping materials and the effective treatment of wastes—both domestic and industrial. It is available to you. A copy of the current issue will be sent to you promptly upon request. Contact your local Yeomans representative, listed in the Yellow Pages of your telephone book under "Pumps"—or write Yeomans direct.

ADVERTISEMENT

The Heart of fine
WATER
PURIFICATION

MECHANICAL EQUIPMENT
BY
ROBERTS FILTER MFG. CO.
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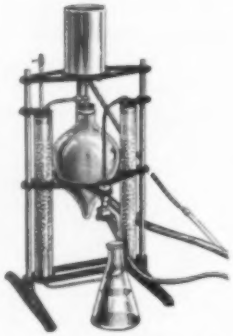
SYSTEMS

Roberts
Mechanical
Equipment

ROBERTS FILTER Mfg. Co.
607 COLUMBIA AVE.
DARBY, PA.

ENSLOW
STABILITY
INDICATOR



For checking the equilibrium of a finished water, and supplying an index useful in controlling anti-corrosion treatment. Catalog No. 83-895

WRITE:
Phipps & Bird, Inc.
P. O. Box 2V Richmond 5, Va.

News of Suppliers

Wallace & Tiernan Promotes Browning

Wallace & Tiernan, Incorporated, Belleville, N. J., has announced that Robert T. Browning has been named Executive Vice-President. He will assume his new duties on Jan. 1, 1958.

Mr. Browning has been associated with Wallace & Tiernan, Inc. since 1930, starting as a field engineer selling chlorination equipment. Since then he has held many responsible positions as the company developed diversified interests in the fields of chemicals, pharmaceuticals, precision instruments and chemical feeding. For the past four years he has held the position of Vice-President, directing the sales activities of Wallace & Tiernan's three chemical divisions and the sales and engineering activities of the five equipment divisions and subsidiaries.

Mr. Browning graduated from the University of Virginia with a degree in civil engineering.

Komline-Sanderson Appoints Tex-Vit Supply Co.

Komline-Sanderson Engineering Corporation, Peapack, N. J., announces the appointment of Tex-Vit Supply Co., Mineral Wells, Texas, as sales representative handing the Komline-Sanderson Coilfilter and Pneumatic Sewage Ejector in Texas, Oklahoma, Southern Arkansas and N. M. east of the Rio Grande River.

Dorr-Oliver Promotes Cerny and Cardwell

Dorr-Oliver Inc., Stamford, Conn., has announced the promotion of Paul J. Cerny and Edward C. Cardwell to the posts of Assistant Manager of the Eastern and Central Sanitary Divisions, respectively. In these two newly established posts both men will assist in the administration and supervision of all Dorr-Oliver sanitary sales activities in the populous New England, mid-Atlantic and Central areas.

Mr. Cerny, a civil engineering graduate of Iowa State University in 1929, has served with the South Dakota, Indiana and Kansas State Boards of Health; the Pacific Flush Tank Co. and with the U. S. Public Health Service during World War II prior to joining the Dorr-Oliver staff in 1950. He is a member of the National Society of Professional Engr. and the Sewage and Industrial Wastes Associations of New York, New Jersey and Pennsylvania.

Mr. Cardwell, a member of the D-O Central Sanitary Div. since 1949, was graduated as a civil engineer from the Illinois Institute of Technology in 1937. He later attended graduate classes at this same institution. His professional experience includes service with the Sanitary District of Chicago and with consulting engineering firms in the Chicago area. During World War II he was Post Sanitary Engr. at Truax Field near Madison, Wis.

Mr. Cardwell is a member of the American Society of Civil Engineers, the Central States Sewage and Industrial Wastes Association and the Chicago Engineers Club.

Sparling Meter Starts New Addition

Sparling Meter Co., El Monte, Calif., has announced that construction has started on the addition to the El Monte Plant, and completion should be accomplished sometime this fall. This addition will allow complete consolidation of the Los Angeles and El Monte factories into one single unit in El Monte.

Complete facilities will consist of four acres of ground, one factory area consisting of approximately 42,000 feet which will house the entire manufacturing operations, with an additional 30,000 foot building on the property which is owned and may be utilized by Sparling if required for future plant expansion.

Dresser Opens Expanded Zurich Offices

Dresser Industries, Inc., Dallas, Texas, has announced the formal opening of new and expanded offices in Zurich, Switzerland.

Dresser A. G., the Zurich-based subsidiary, has sales and service representatives throughout the Eastern hemisphere, and also serves to coordinate the manufacturing and mining operations of Dresser Industries, Inc., in England, France, Germany, Holland, Italy and Greece.

DIFFUSAIR SPARJERS

AN ORIGINAL WALKER PROCESS DEVELOPMENT

Odessa, Texas where six main aeration tanks, two holding tanks and two grease removal tanks are SPARJER equipped. Walker Process also furnished CIRCULAR COLLECTORS, FLOTATION UNIT, DIGESTER MIXER, HEATX SLUDGE HEAT EXCHANGER AND SKIMMERS at Odessa.

Parkhill, Smith & Cooper, Lubbock, Texas • Consulting Engineers
Mr. M. Breneman — Plant Superintendent

Diffusair SPARJERS, designed and developed by Walker Process, represent years of research and experimentation in conjunction with a continuing study of oxygenation processes. As the number of new and tube replacement installations increase, more and more Engineers and Plant Superintendents recognize that SPARJERS successfully combine controlled air bubble release with increased tank turbulence and circulation velocities to achieve an oxygenation efficiency actually superior to other types of diffusion devices.

In developing the SPARJER, Walker Process Engineers thoroughly investigated all factors pertaining to the complex processes involving aeration and oxygenation. As a result Diffusair SPARJERS provide maximum oxygen absorption and include such features as CLOG-PROOF SELF CLEANING ORIFICES . . . NO AIR FILTERS REQUIRED . . . POSITIVELY NO BACK PRESSURE BUILD-UP . . . ECONOMICAL OPERATION.

Full-sized plant tests conducted at SPARJER installations in recent years have demonstrated their superior design. In many cases SPARJERS are installed on existing headers which formerly supported diffusion tubes.

The complete SPARJER story is covered in Walker Process Bulletin Number 22S90. Here the theory and development is discussed in detail along with actual plant experience and data. Write for your copy today.

WALKER PROCESS

WALKER PROCESS EQUIPMENT INC.
FACTORY • ENGINEERING OFFICES • LABORATORIES
AURORA, ILLINOIS

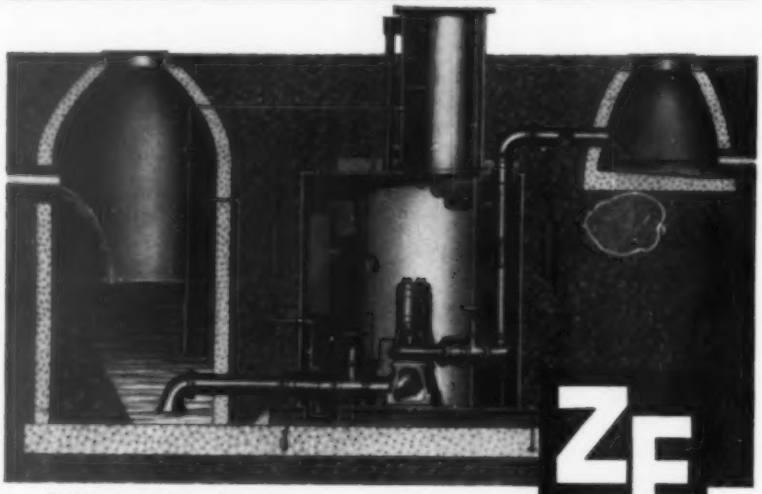
CLOSES and SEALS POSITIVELY

"D-D" Diaphragm Valve

Disc for Positive Closure
Diaphragm for Positive Sealing

- No packing gland to leak. Mechanism not exposed.
- Oversized ports; high capacity; low pressure drop. Largest capacity of any diaphragm type valve.
- Self-draining in horizontal position.
- Lower handwheel torque and fewer turns to close.
- Automatic control available.
- Body of any metal or with any lining. Sizes ½" to 6". Write for Bulletin

W. S. ROCKWELL COMPANY
2828 ELIOT STREET • FAIRFIELD, CONN.
Sales Representatives in Principal Cities



ZF

Before engineering your sewerage system consider the advantages of this...

PREFABRICATED PUMPING STATION

- Installation can be made with a minimum of time and cost.
- Can be installed on existing public property.
- Entire unit is prefabricated and shop-fitted with standard, well-known equipment.
- Usually can be located at most advantageous spot for existing gradients.
- It is feasible to move and relocate should conditions change.
- Improved equipment, controls and prefabricating technique make the Z-F Station an economical and reliable unit. Write for details. (Territories open for representatives)

Manufactured by ZIMMER & FRANCESCON, Moline, Illinois

New Bulletins

CONTINUED FROM PAGE 26A

reviews industrial pH control systems, their principles, application engineering and equipment, providing a convenient reference source on pH for persons involved in designing, engineering, purchasing, and operating industrial pH systems. Systematic subject organization plus alphabetical indexing makes for easy reference to the subjects covered. The handbook contains approximately 100 illustrations, plus charts, tables, and a bibliography of reference literature on pH measurement. **Price: $2 per copy.**

Water Works Valve-Hydrant Catalog

121

Darling Valve & Manufacturing Company, Williamsport, Pa., has just published a 72-page catalog-type bulletin, giving detailed, up-to-the-minute information on gate valves, check valves and hydrants especially developed and produced for Water Works Service.

This new bulletin, virtually doubles the size of the bulletin it replaces, due to inclusion of far more extensive information on available types, accessories, dimensions, applications, construction details, special features, testing, operating methods, etc., than has been the practice in the past.

Instrument Accessories And Supplies

122

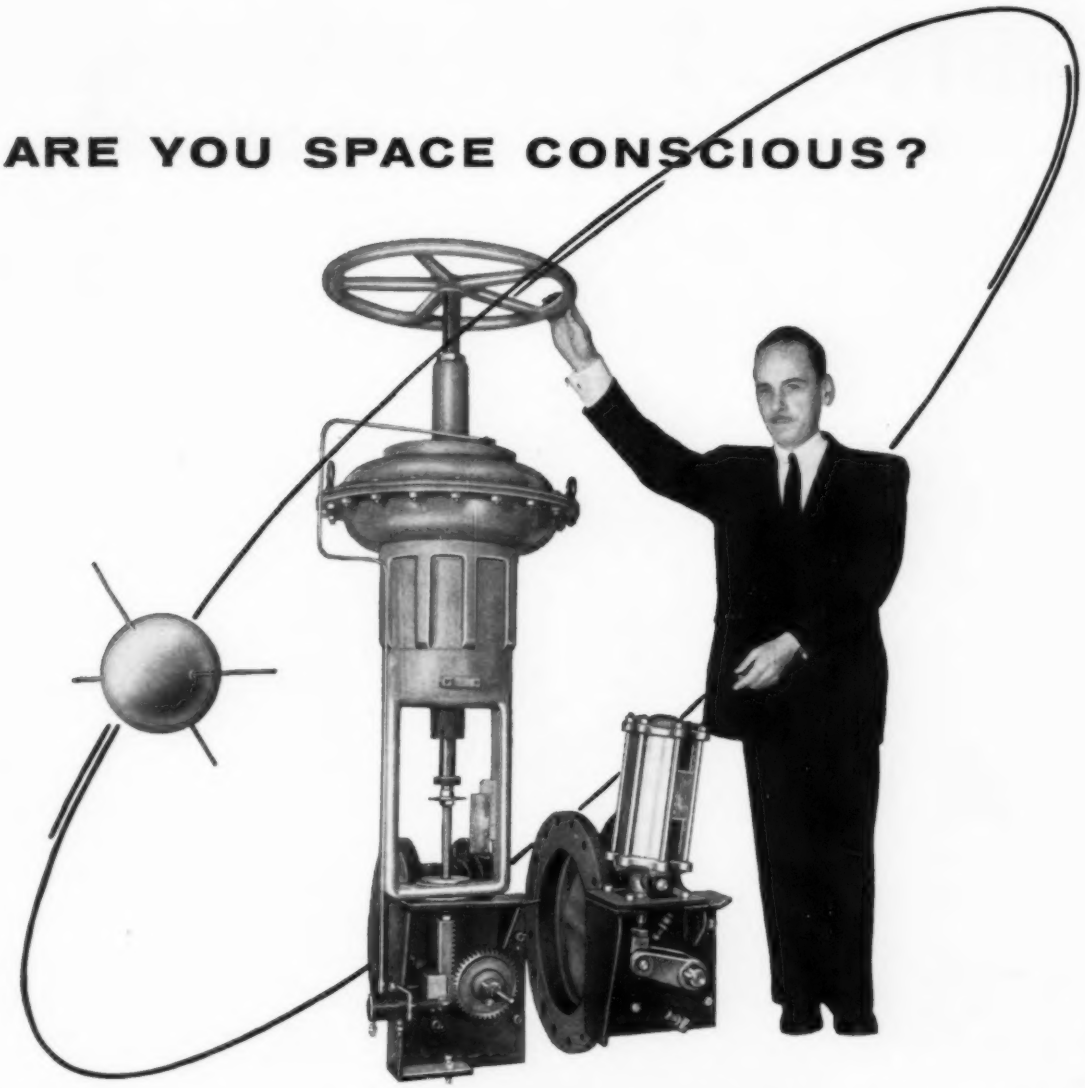
The Foxboro Company, Foxboro, Mass., has announced that complete information on industrial instrument **Accessories and Supplies** has been compiled in a new 60-page catalog, available to Foxboro Instrument users. The loose-leaf book, includes specifications, part numbers and prices for more than 250 commonly furnished instrument parts and supplies.

In addition to an alphabetical index, the illustrated catalog is divided into five sections: Mechanical, Pneumatic, Electric-Electronic, General, and Tools and Service.

Among the items covered are pressure gauge and flow meter accessories, thermometer wells, bush-

CONTINUED ON PAGE 100A

ARE YOU SPACE CONSCIOUS?



Simple, rugged design assures positive operation and minimum maintenance for the life of the valve.

Investigate the space saving characteristics of Builders-Providence built Hydraulic Operators for Butterfly Valves!

Why does the manufacturer who pioneered in the development of pneumatic instrumentation in water works now recommend hydraulic operators for butterfly valves? The reasons speak for themselves—

COMPACT SIZE . . . Compare the hydraulic cylinder operator on the 16″ Builders (AWWA) Butterfly Valve with the air diaphragm operator on the smaller 14″ valve shown above . . . and consider the savings in construction costs alone. More compact pipe galleries minimize costs . . . these space-conserving, customized operators permit tight piping layouts and eliminate the materials and labor costs of special construction and supports.

SMOOTHER OPERATION . . . Incompressible hydraulic liquids give positive regulation *on valves of all sizes.* No spongy hunting action.

POSITIVE SPRINGLESS OPERATION . . . No excessive wear on linkages, bearings, and packings. No overtravel.

AWWA CONSTRUCTION . . . Rugged *corrosion-resistant* construction to AWWA Standards assures the user of long life and trouble-free operation.

NO DANGER of blown diaphragms which can cause violent water hammer . . . particularly dangerous in long pipe lines.

Contact the leading specialized supplier of water works and sewage equipment for additional reasons why *you* should insist on Builders Butterfly Valves with hydraulic operators. Write

Builders-Providence, Inc., 350 Harris Ave., Providence, R. I. for Bulletin 650-L1B.

BUILDERS-PROVIDENCE
DIVISION OF
B-I-F INDUSTRIES
BIF METERS FEEDERS CONTROLS

GUNITE does it 2 times as fast at 1/2 the cost

"Gunite" is the modern process (sand and cement applied pneumatically) for repairing, constructing, lining:

- Reservoirs
- Dams
- Filter Plants
- Sewage Disposal Plants
- Tanks
- Stadiums
- Bridges
- Sea Walls
- Swimming Pools, etc.

WRITE FOR MORE INFORMATION, INCLUDING 48 PAGE "GUNITE" BOOKLET.

PRESSURE Concrete Co.

FLORENCE, ALA. 1555 Helton Street

OTHER OFFICES IN

CHICAGO, ILL. 30 W. Washington Street

NEWARK 5, N. J. 193 Emmet Street

For Simplicity of Installation, Operation, and Maintenance, SPECIFY . . .

Sparling 906

One meter... Dual Application

CAN BE MOUNTED AS A MANHOLE METER OR WELDED SADDLE

The rugged, dependable Sparling 906 represents a new concept of meter installations. The 906 meterhead assembly is mounted directly on a standard AWWA flanged "T" or flanged manhole outlet for immediate operation . . . as a Welded Saddle Meter, it's furnished with a fabricated saddle permitting the meter to be mounted easily on an existing steel pipe. In saddle application, weight is reduced considerably and installation is simple. Sizes 16 to 72 inches.

☐ Yes! We are interested in increasing our metering efficiency. Send us more information . . . no obligation, of course.

☐ Also send information on Sparling's line of Water Control Equipment.

Name_____

Company_____

Address_____

City_____ Zone_____ State_____

Send to: SPARLING METER COMPANY
229 N. Temple City Blvd., El Monte, California

OTHER OFFICES:

Atlanta • Chicago • Cincinnati
Dallas, Texas • Kansas City, Mo.
Los Angeles • Roselle, N. J.
San Francisco • Seattle • Toronto, Can.
Romford, England

New Bulletins

CONTINUED FROM PAGE 98A

ings and flanges, air supply regulators and filter sets, thermocouples, dew point elements, charts, chart drives, instrument pens and ink.

Cut-In Valves

123

Golden-Anderson Valve Specialty Company, Pittsburgh, Pa., has just issued a new four-page bulletin describing their **Cushioned Emergency Cut-In Valve.**

This valve automatically opens to the emergency water supply when the plant's normal water supply is interrupted, either from outage of electrical power or mechanical failure causing pump shut-down. Schematic drawings of installation, parts lists and dimensions are included with other pertinent technical data.

Water & Sewage Gates

124

Armco Drainage & Metal Products, Inc., Middletown, Ohio, has available a new illustrated bulletin showing how their complete line of **Gates** meets municipal water and sewage control requirements.

Some of the subjects covered are watertightness, economical selection, fast, easy operation, and long service life. Size range and operating pressures are listed and accessories and related products described. Among the applications are sewer outfalls, pumping stations, culvert drainage, flood control, reservoirs, recreation ponds, levees, and cooling towers.

Ductile Iron Valves

125

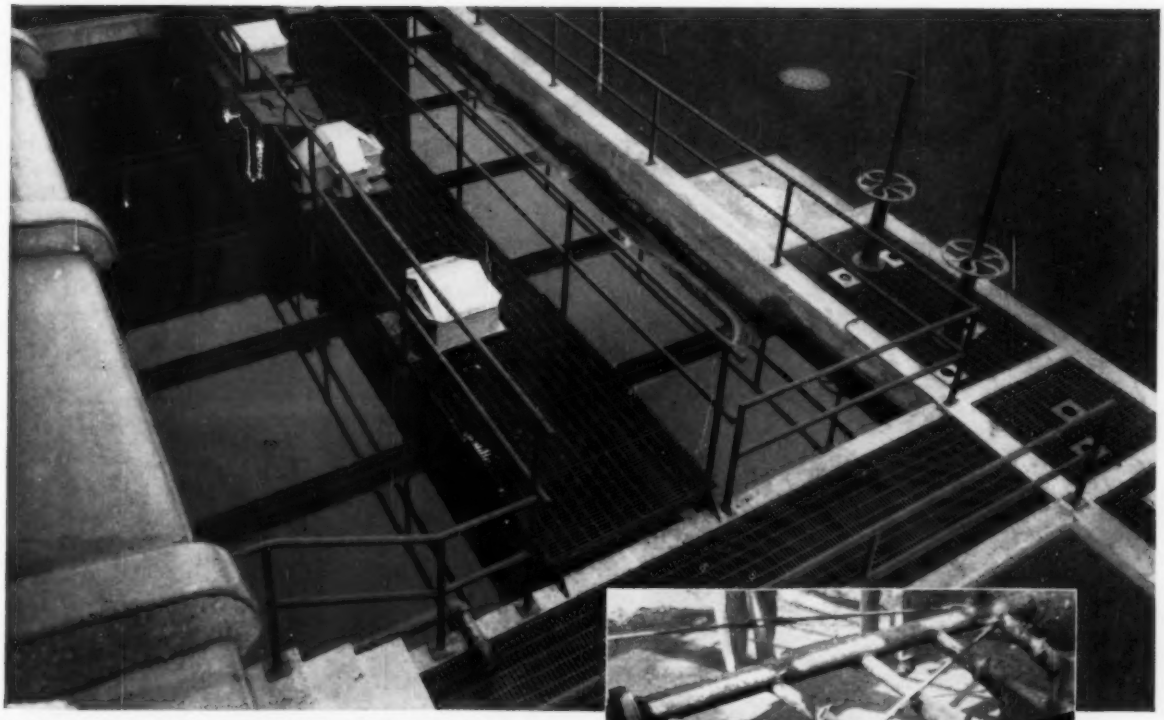
Kennedy Valve Mfg. Co., Elmira, N. Y., has just published a new bulletin describing in detail **Kennedy Ductile Iron Valves.**

The bulletin describes in specific steps the elaborate testing and research conducted by the company under the supervision of Professor J. O. Jeffrey of Cornell University before production was begun.

The bulletin also describes the advantages of Ductile Iron and gives specifications on the metal as well as on Ductile Iron Valves in actual use.

CONTINUED ON PAGE 102A

REX® TOW-BRO®



Barrington, Illinois—Sludge treatment plant. Consulting Engineers—Consoer, Townsend and Associates; John H. D. Blanke—Chairman, Sewage Commission; Fred Hager—Plant Superintendent. Mr. Hager reports, "Had 20 years' service with Rex Tow-Bro and very satisfied. Expect even better performance with new Rex Unitube Tow-Bro."

20 years' steady service ...and look at its near-perfect condition!

20 years, no trouble. That's the service record of Rex TOW-BRO at Barrington, Illinois. And a close look at this unretouched photo indicates there are 20 years' more service still there.

Long-time performance like this is essential to your plant, too. But more than this is the remarkable efficiency of the Rex TOW-BRO Sludge Remover. Now improved with new UNITUBE design, there is even more gentle suction action. Agitation is at absolute minimum. Sludge removal rate is faster, even with high solids concentration. It more effectively handles light, flocculent and "tricky" sludges.

Most important to budget-conscious communities, this new simpler Rex UNITUBE TOW-BRO—while actually performing more efficiently—saves in equipment costs. Fits any tanks, new or existing. Bulletin No. 315-81 has the complete money-saving story. Write to: CHAIN Belt Co., 4610 W. Greenfield Ave., Milwaukee 1, Wis.

CHAIN BELT COMPANY

MILWAUKEE 1, WISCONSIN

1. Large illustration shows Singl-use Fiberform ready to be filled.
2. Filling plate and collar simplify pouring concrete into form.
3. Completed meter box barrel.
4. Meter box with cover in place.

FOR ECONOMICAL SETTINGS

Make Your Own

CONCRETE METER BOX BARRELS *with*

FORD *Singl-use Fiberforms*

Water utilities that find vitrified or concrete tile expensive or difficult to obtain, may now make their own barrels for outside meter settings with Ford Singl-use Fiberforms which are inexpensive and easy to use. Forms made for 15", 18" and 20" ID barrels and in lengths of 15", 18" and 24". Use two for deep settings. Send for full information.

FOR BETTER WATER SERVICES **FORD**

THE FORD METER BOX COMPANY, INC. Wabash, Indiana

HYDRO-TITE

DEPENDABLE JOINTING COMPOUND

Seals Bell and Spigot Water Mains

Economical—Effective

Over 35 Years Of Dependable Performance

HYDRAULIC DEVELOPMENT CORP.

MAIN SALES OFFICE **50 CHURCH ST., N. Y. C.**

General offices and works W. Medford Sta., Boston, Mass.

New Bulletins

CONTINUED FROM PAGE 100A

In addition, the six page brochure lists Kennedy Ductible Iron Valves now available and those which can be supplied.

Bronze Goods Catalog

126

Pubco Bronze, Los Angeles, Calif., has just released a new Bronze Goods Catalog covering their line of Corporation Stops, Service Stops, Curb Stops, Fittings and Valves. The products are fully illustrated and described and are designed especially for use by the Waterworks, Petroleum and Natural Gas Industries as well as for Municipal and Privately Owned Water Companies, Pipe Line Contractors and for Irrigation uses.

All of the bronze goods shown are guaranteed to meet A.W.W.A. Specifications. The catalog also contains a "Convenient Comparison Chart" which lists, opposite the Pubco Bronze stock numbers, the stock numbers of other manufacturers making similar products.

Valve Sizing Charts

127

Jordan Corporation, Cincinnati, Ohio, has just published a 4-page bulletin on **Sizing Charts.**

The bulletin shows how to size OPW-Jordan sliding gate regulator valves. Technical data (applying to all makes of valves) tells how to adjust sizing for variations in pressure, temperature, viscosity, specific gravity, etc. Charts cover steam, liquid, and gas services. Cross-reference method of compiling eliminates need to use rulers or slide-rules.

Rotary Compressors

128

Davey Compressor Co., Kent, Ohio, has released a bulletin showing component parts of its new **Hydrovane Rotary Compressors.**

Among features stressed is accessibility for inspection or repair. This is said to be unmatched by any other rotary. Davey Compressors are also reputed to have 50% fewer working parts than other machines.

CONTINUED ON PAGE 104A

Palatable Water Results in "GOOD WILL"

Aqua Nuchar Activated Carbon will render water palatable only if proper dosages are used. Efforts to produce palatable water will be defeated by attempting to stretch out the minimum dosages to cover periods of maximum requirements.

Sudden odor surges must be accompanied by an increased Aqua Nuchar dosage sufficient to reduce the odor concentration to palatable levels. It is difficult to distinguish the difference between a highly odorous water and that same water with only 50% of the odor present. Therefore, halfway measures in palatability are similar to using only enough water to put a fire half out.
We can help you make your water palatable. A member of our technical staff will work at your plant to achieve this end, at no cost or obligation to you.

GOOD CARBON · GOOD WATER · GOOD WILL

industrial CHEMICAL SALES
division west virginia pulp and paper company

New York Central Building
230 Park Ave., New York 17, N. Y.
Phila. Nat'l Bank Bldg.
Broad & Chestnut Sts., Phila. 7, Pa.

Pure Oil Building
35 E. Wacker Drive, Chicago 1, Ill.
2775 S. Moreland Boulevard
Cleveland 20, Ohio

For Important Information
on Products and Services
see the 1957-1958
WATER & SEWAGE WORKS
REFERENCE and DATA NUMBER

The following firms have information of interest to you in the 1957-58 REFERENCE and DATA NUMBER

Airkem, Inc.
Alabama Pipe Co.
Allis-Chalmers
Amercoat Corp.
American Vitrified Prod. Co.
American Well Works
Anthracite Equipment Co.

Bailey Meter Co.
Beaumont Birch Co.
Bethlehem Steel Co.
B-I-F Industries, Inc.
Borden Metal Products Co.
Builders-Providence Inc.
Byron Jackson Pumps, Inc.

Chain Belt Co.
Chicago Bridge & Iron Co.
Chicago Pump Co.
Clarksville Foundry & Machine Works
Jas. B. Clow & Sons (Iowa)
R. D. Cole Mfg. Co.
Columbia Southern Chem. Co.
Combustion Engineering, Inc.
Cook Well Strainer Co.

Dorr-Oliver, Inc.

Fischer & Porter Co.
Foster Eninecring Co.

General Chem. Div.
Allied Chem. & Dye Corp.
General Filter Co.
Golden-Anderson Specialty Valve Co.
Graver Tank & Mfg. Co.
Graver Water Conditioning Co., Inc.

Hardinge Co., Inc.

Infilco, Inc.
Ingalls Iron Works Co.
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WATER & SEWAGE WORKS REFERENCE and DATA NUMBER • INDUSTRIAL WASTES • MODERN HIGHWAYS

New Bulletins

CONTINUED FROM PAGE 102A

Illustrations include cut-a-way photos taken from directly below the unit and sectional views of each side.

Oil separators, segmented rotor vanes, control panels and the engine speed control are among the components shown.

Rust Prevention Systems

129

L. Sonneborn Sons, Inc., Building Products Division, New York, N. Y., has available a four page brochure outlining applications and advantages of **The Sonneborn Rust Prevention System.**

It includes information on where, when, and how to use S.R.P. 75 Primer for priming rusted surfaces; and S.R.P. 87 Finish Coat, which adheres to and coats metal surfaces with a protective finish.

It tells how these coatings provide greater durability and elasticity in contact with the corrosive elements. Results of adhesion, immersion, fume, electrolytic breakdown accelerated weatherometer, and field performance tests are also pointed out.

In addition, the publication covers complete specifications for the Sonneborn products which comprise the Rust Prevention System and offers detailed, technical, and packaging and shipping data.

Seventeen applications are pictured in a series of sketches, together with a partial list of SRP users.

Geared Flexible Couplings

130

Link-Belt Co., Chicago, Ill., has published a new book describing the company's complete line of improved **Geared Flexible Couplings.**

The Book, a completely new 12-page publication, details pertinent application and selection data for couplings with maximum bores ranging up to seven inches and ratings from 2½ to 572 horsepower per 100 r.p.m.

According to the book, Link-Belt's design of geared flexible couplings provides extra large bore

New Bulletins

capacity in proportion to outside diameter. It transmits more power, size for size, than other comparable couplings. Housing halves are of forged steel solidly joined by hardened and ground socket head through bolts with lock nuts, arranged for one-tool assembly. Effective quad-ring hub seals retain lubricant and exclude dust, water or other destructive matter.

All Transistor Amplifier

131

The Systems Division of **Beckman Instruments, Inc.**, Fullerton, Calif. now has available on request, a four page brochure on the **Beckman All Transistor Amplifier.**

According to the brochure this unit is a high gain, broad band, chopper stabilized, precision amplifier designed specifically for use in analog computation and amplification for low level DC signals such as strain gage transducers or thermocouple output. High reliability over conventional amplifiers is due primarily to its being fully transistorized, light weight, cool, and free of microphonics, plus a built-in power supply that will accept imputs up to plus or minus 15 volts and has an output capability of plus or minus 15 volts at 100ma.

This brochure is very descriptive, utilizing complete diagrams, block diagrams and photographs explaining operation, typical applications and operations specifications.

Polyethylene Ware For Laboratories

132

Fisher Scientific Company, Pittsburgh, Pa., has just published an 8-page bulletin on **Fisher Polyethylene Ware.**

Featured in the bulletin are beakers with a softening-point above 250°F; 13-gallon polyethylene aspirator bottles with all-polyethylene spigots; translucent tubing that contains no plasticizers, retains flexibility even on aging; a high-safety pipet-filler that cannot spill even when knocked over; and just about everything from one-ounce vials to giant carboys approved by the Interstate Commerc Commission.

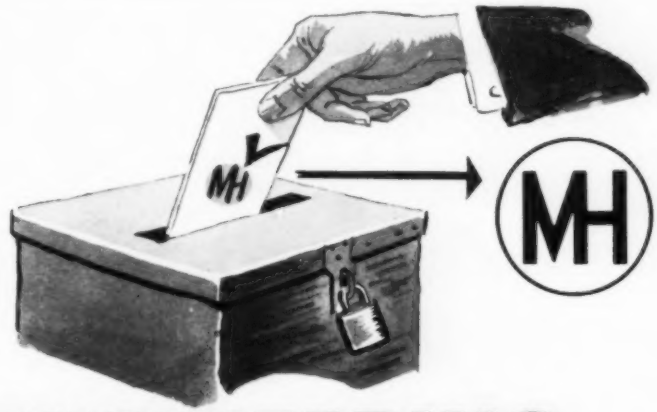
Trencher Catalog

133

Cook Bros. Equipment Co., Los Angeles, California, has recently released a new 8-page catalog illustrating and describing the **Challenge Universal Trencher.**

According to the catalog the Challenge Trencher is a ladder type machine, and will dig trenches to 5′ 3″ deep and from 12″ to 18″ wide with square or round bottom. The ladder, bucket line, and reversible conveyor are all hydraulically operated. A backfill blade for clearing ahead of the machine, leveling high spots, and refilling trenches, is standard equipment.

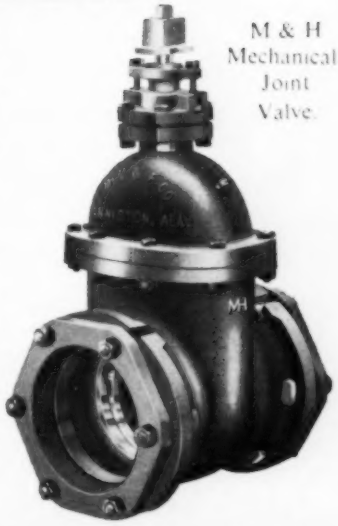
The new catalog also gives complete specifications.



ENGINEERING BALLOT BOX

We like to think of M & H valves and hydrants as "candidates" in an election contest. The "voters" are the engineers and water works men of the United States. The "ballots" are material specifications and purchase orders. As this "election" stands today, M & H products rank high among the winners.

For many years, the sale and use of M & H valves and hydrants has been rapidly and steadily growing. Our company has become a leading producer of valves, hydrants and accessories. Returns from the engineering ballot box we consider as an emphatic vote of confidence. Our pledge, therefore, is that M&H products shall continue to merit that confidence through the years to come.



M & H Mechanical Joint Valve.

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Safety Equipment

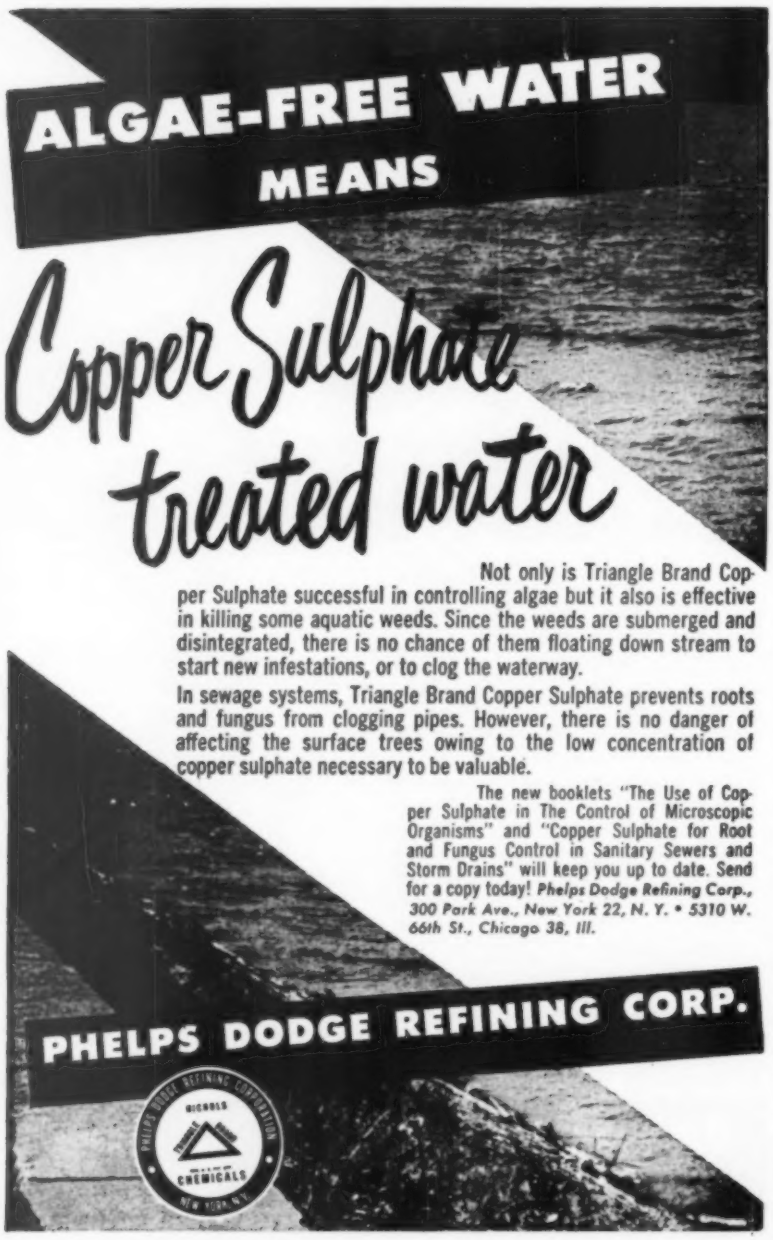
134

General Scientific Equipment Co., Philadelphia, Pa., has just published a catalog that presents the company's entire line of **Safety Equipment** in an easy-to-use buyers'-guide arrangement.

Transmission Equipment

135

The Jeffrey Manufacturing Co., Columbus, Ohio, has available a new 88 page catalog featuring **Jeffrey Transmission Products** and their uses in elevating and conveying machinery.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Liquid Strainers

136

Golden-Anderson Valve Specialty Co., Pittsburgh, Pa., has just published a bulletin on **Self-Cleaning Liquid Strainers.**

Standard Motor Bulletin

137

Sterling Electric Motors, Inc., Los Angeles, Calif., has just published a 12 page colored brochure describing the complete Sterling line of **Standard Electric Motors.**

Meters and Controls

138

Bailey Meter Co., Cleveland, O., has just published a new 8-page, 1957 edition of the **Bailey Meter Annual Bulletin** that presents all the instruments introduced within the last year.

Ground Water Movie

139

Layne & Bowler, Inc., Memphis, Tenn., has available a full color and sound 16 mm motion picture on ground water development. The film is titled **"Deep Waters."**

Utility Ditcher

140

Gar Wood Industries, Inc., Wayne, Mich., has just released a new catalog, featuring the improved Gar Wood-Buckeye **Model 403 Utility Ditcher.**

Sweco Surface Condenser

141

Southwestern Engineering Co., Los Angeles, Calif., has just published an illustrated bulletin describing its new line of **Surface Condensers.**

General Service Pumps

142

Economy Pump Div., C. H. Wheeler Manufacturing Co., Philadelphia, Pa., has just published a four-page, two-color catalog describing the company's line of redesigned **General Service Pumps.**

Motor Controls Bulletin

143

Allis-Chalmers Mfg. Co., Milwaukee, Wis., has just released a bulletin on **Motor Controls** giving the latest design features in Allis-Chalmers front access, high voltage starters for 2300 to 5000 volt motors which provide maximum accessibility, protection, performance and space economy.

Chemical Feeder Catalog

144

Manzel, a division of Houdaille Industries, Inc., Buffalo, N. Y., has just released a comprehensive new catalog on its line of **Chemical Feeders.**

Non-Clog Pumps

145

Economy Pump Div., C. H. Wheeler Mfg. Co., Philadelphia, Pa., has released a new four-page, two-color catalog describing their complete line of **Horizontal Non-Clog Pumps.**

Preparation of Sewage Sludge For Fertilizer

146

Royer Foundry & Machine Co., Kingston, Pa., has just published a bulletin, pointing out a combination of factors, social as well as economic, that are responsible for the increasing popularity of sewage sludge as a soil conditioner. These factors, the bulletin explains, makes it possible for the Sewage Disposal Plant Superintendent to dispose of his "by-product" with an economic advantage to his operation and the community he serves.

Comminutor Handbook

147

Worthington Corp., Harrison, N. J., has just prepared a new **Selection and Application Handbook on Comminutors** for sewage and industrial waste treatment.

Controlled Volume Pumps

148

The Milton Roy Company, Philadelphia, Pa., has released a Bulletin on **H20® Controlled Volume Pumps.**

Filter Cloth Catalog

149

The National Filter Media Corp., New Haven, Conn., has available a new bulletin giving complete technical data on all types of **Filter Cloth.**

Plastic Pipe

150

A. M. Byers Co., Pittsburgh, Pa., has just published a catalog giving the general characteristics, properties, applications and installation techniques of **Byers PVC Pipe.**

Large Clay Pipe

151

Robinson Clay Product Co., Akron, Ohio, has just published a new, four-page brochure, **"Big Pipe by Robinson".**

Drafting and Computtaion Shortcuts

152

Frederick Post Co., Chicago, Ill., has just published a booklet on **Time Saving Tips for the Draftsman and Engineer.**

CONTINUED ON PAGE 108A

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4826

CONTINUED FROM PAGE 107A

Plastic Pipe Fittings and Valves

153

Sloane Mfg. Co., Sun Valley, Calif., has just published a new illustrative brochure and stock catalog on **Plastic Pipe Fittings and Valves.**

Extending Cooling Tower Life

154

The Milton Roy Co., Philadelphia, Pa., has released a new **Application Engineering Data Sheet.** This four-page data sheet describes several methods of combating corrosion and delignification in cooling towers, using controlled volume pumps to meter precise quantities of chemicals to cooling water.

Rigid Polyvinyl Chloride Pipe

155

Alpha Plastics Inc., Livingston, N. J., has just published a 12-page two-color catalog on **Alpha Pine, Fittings and Valves.**

White Superior Diesels

156

White Diesel Engine Div., The White Motor Co., Springfield, Ohio, has just issued a bulletin on the Model 60 and Model 80 **Superior Stationary Diesels.**

Walking Beam Flocculators

157

Stuart Corp., Baltimore, Maryland, has just published a Question and Answer booklet on Walking Beam Flocculating Equipment.

Blowers, Gas Pumps, Vacuum Pumps

158

Sutorbilt Corp. a subsidiary of Fuller Co., Maywood, Calif., has just released a new eight-page, two-color bulletin describing **Sutorbilt Blowers, Gas Pumps and Vacuum Pumps.**

Cushioned Valves

159

Golden-Anderson Valve Specialty Co., Pittsburgh, Pa., has just published a 4-page bulletin on Golden-Anderson **Cushioned Valves in Action.**

Vitrified Clay Products

160

Robinson Clay Product Co., Akron, Ohio, has just published a completely new, four-page technical bulletin on **Vitrified Clay Products.**

Saunders Valves

161

Conoflow Corp., Philadelphia, Pa., has just issued a new bulletin describing the company's complete line of **Air-Operated Saunders Patent-Type Valves.**

Meter Diaphragm Pumps

162

Hills-McCanna Co., Chicago, Ill., has just published a new two-color, four-page bulletin describing the new **McCannameter.**

The Story of Diamond Chemicals

163

Graphically depicting in word and picture its diverse, growing family of chemical products for industry and agriculture, Diamond Alkali Company, Cleveland, Ohio, has just published the fifth edition of **The Story of Diamond Chemicals—Chemicals You Live By.**

Sho-Rate Rotameter

164

Brooks Rotameter Co., Lansdale, Pa., has just published a bulletin on the new, low cost **Sho-Rate Rota-meter** with the 150 mm scale length for greater readability.

Electric Brakes and Clutches

165

Warner Electric Brake & Clutch Co., Beloit, Wis., has released a new catalog digest giving easy to read facts about **Electric Brakes, Clutches** and controls for miniature mechanisms or high torque machine drives.

Sewer Construction Film

166

Clay Products Association, Chicago, Ill., has available a new sound, color film presenting the latest and most efficient methods of sewer construction.

Veriflow Meters

167

Hays Corp., Michigan City, Indiana, has just published an 8-page catalog on **Veriflow Meters and Veritrol Controls.**

Valve Lubrication Maintenance Chart

168

Rockwell Manufacturing Company, Pittsburgh, Pa., has released a new 19-by-24-inch, three color chart containing **Maintenance and Lubrication** information for Rockwell-Nordstrom lubricated plug valves.

Enclosed Gear and Variable Speed Drives

169

Link-Belt Co., Chicago, Ill., has announced that for easy reference in selecting **Stock Drives** available for immediate shipment from the many Link-Belt warehouses throughout the U. S., folder 2642 is being distributed by district offices and authorized industrial distributors.

Planning for New Sewers

170

Clay Products Assn., Chicago, Ill., has just published a brochure **Planning For New Sewers** that describes the values and benefits of properly installed and adequate sanitary sewer systems.

Vertical Non-Clog Pumps

171

The Economy Pump Div., of C. H. Wheeler Manufacturing Co., Philadelphia, Pa., has just published a new four-page, two color catalog describing two types of **Vertical Non-Clog Pumps.**

Water Control Gates

172

S. Morgan Smith Company, York, Pa., has just released a bulletin on **Water Control Gates.** This sixteen page technical bulletin outlines the several basic types of gates and their applications. Discharge curves are shown for preliminary sizing, and specifications are included.

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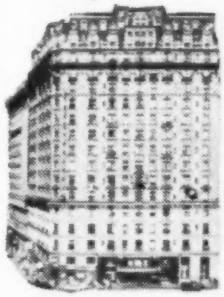

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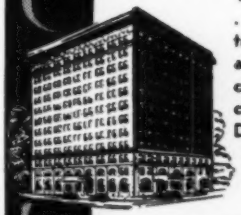

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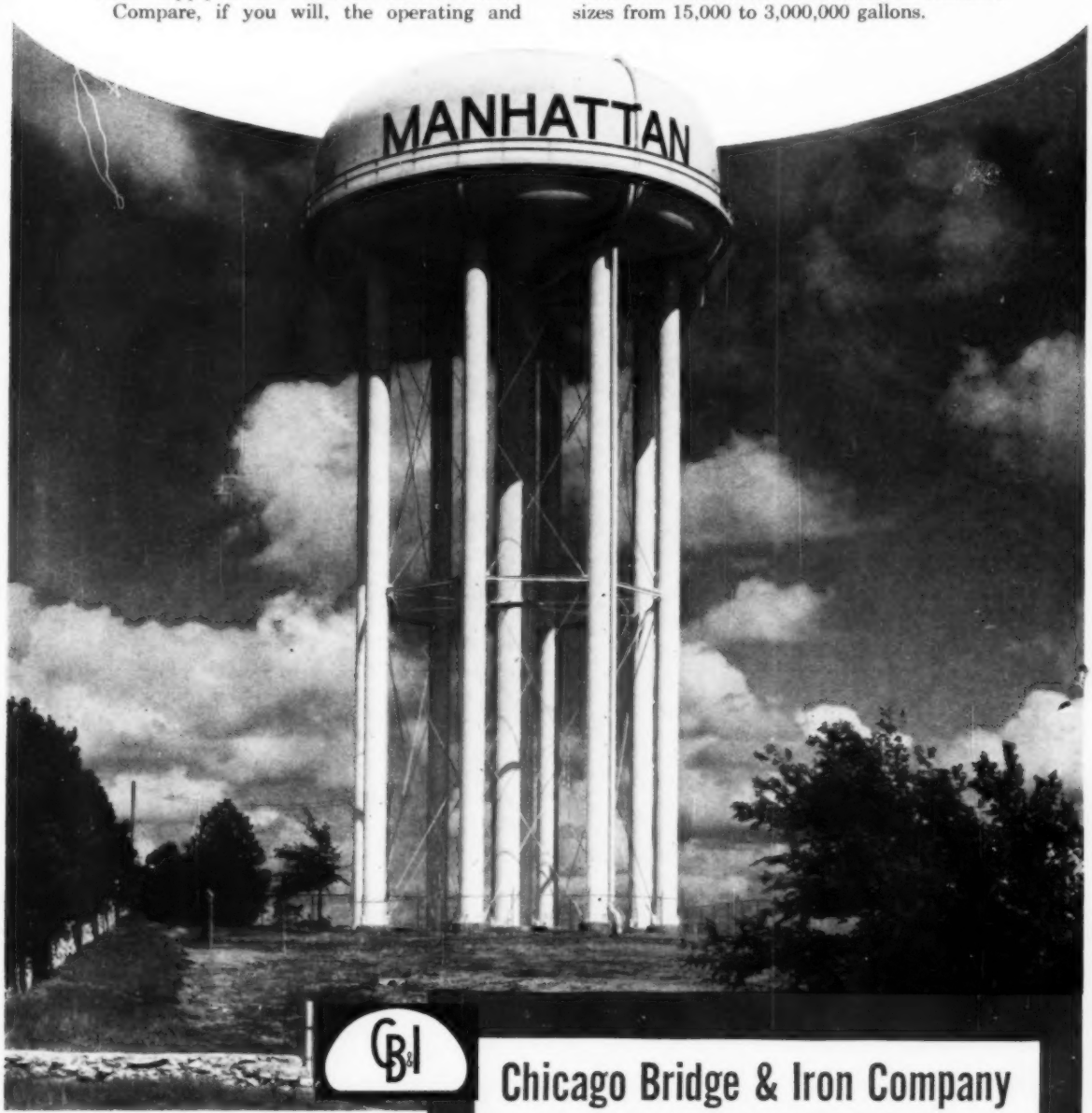

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